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# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA,

INCLUDING

SOUTH ARABIA, BALUCHISTAN, AFGHANISTAN, KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM, MALAY PENINSULA, CEYLON, AND OTHER ISLANDS OF THE INDIAN OCEAN.

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CONCHOLOGIA INDICA.

BY

LIEUT.-COLONEL H. H. GODWIN-AUSTEN,
F.R.S., F.R.G.S., F.Z.S., &c.,

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# INDEX.

## A.

### ALYCÆINÆ, 2, 332.

### ALYCÆUS, 2, 332.


Alyceus *aborensis*, Fig. 9, Pl. CXLIX., Part XII., 364.
—— *akhaensis*, Figs. 1–1 *b*, Pl. CXLI., Part XII., 352.
—— *andamaniæ*, Part XII., 430.
—— *anonymus*, Figs. 1, 1 *a*, Pl. XXXIX., Part XII., 405.
—— *armillatus*, Figs. 3, 3 *a*, Pl. CLI., Part XII., 406.
—— *asaluensis*, Figs. 2–2 *b*, Pl. CXLV., Part XII., 385.
—— *ataranensis*, Figs. 4–4 *b*, Pl. CXLVIII., Part XII., 426.
—— *avæ*, Fig. 6, Pl. CLI., Part XII., 406.
—— *barowliensis*, Fig. 4, Pl. CXLI., Part XII., 352.
—— *beddomei*, Figs. 5, 5 *a*, Pl. CLXIX., Part XII., 386.
—— *bhutanensis*, Fig. 8, Pl. CXLVIII., Part XII., 350.
—— *bicrenatus*, Figs. 5–5 *b*, Pl. CXLIV., Part XII., 386.
—— *bifrons*, Figs. 3, 3 *a*, Pl. CXXXIX., Part XII., 407.
—— *birugosus*, Figs. 5, 5 *a*, Pl. LXIII., Part VII., 2; Fig. 7, Pl. CLIV., Part XII., 370; Figs. 5, 5 *a*, Pl. LXIII., Part XII., 387.
—— *blanfordi*, Fig. 3, Pl. CXLVIII., Part XII., 418.
—— *brahma*, Fig. 3, Pl. XLVIII., Part XII., 363.
—— *busbyi*, Figs. 1–1 *b*, Pl. LXIII., Part VII., 5; Part XII., 431.
—— *burroiensis*, Figs. 6, 6 *a*, Pl. CXLI., Part XII., 354.
—— *burtii*, Figs. 8, 8 *a*, Pl CXLIV., Part XII., 352, 353.
—— ——, var. *yetayensis*, Fig. 7, Pl. CXLIX., Part XII., 353.
—— *canaliculus*, Part XII., 371.
—— *chanjukensis*, Figs. 5, 5 *a*, Pl. CLVII., Part XII., 364.
—— *damsangensis*, vol. i. p. 192 (1886); Figs. 3–3 *c*, Pl. XLIII., Part XII., 339.
—— *gemmula*, Part XII., 340.
—— *oakesi*, Figs. 4, 4 *a*, Pl. CLVII., Part XII., 366.
—— *subhumilis*, Part XII., 344.
—— *chennelli*, Figs. 1–1 *c*, Pl. XLVIII., Part XII., 387.
—— ——, var., Fig. 2, Pl. XLVIII., Part XII., 387.
—— *commutatus*, Fig. 7, Pl. CXLVIII., Part XII., 351.

Alycæus *conicus*, Figs. 4–4 *b*, Pl. CXLIII., Part XII., 387.
—— ——, var. *nanus*, Figs. 6–6 *b*, Pl. CXXXVIII., Part XII., 388.
—— *constrictus*, var. *minor*, Part XII., 348.
—— *crenatus*, Figs. 8–8 *c*, Pl. CXLIII., Part XII., 388.
—— *crenulatus*, Figs. 1–1 *c*, Pl. CXXXIII., Part XII., 337.
—— *crispatus*, Figs. 1–1 *b*, Pl. CXLV., Part XII., 371, 389.
—— ——, var. *makarsæ*, Fig. 13, Pl. CLVIII., Part XII., 372.
—— ——, var. *minimus*, Figs. 5, 5 *a*, Pl. CXLVIII., Part XII., 373.
—— ——, var. *rywukensis*, Figs. 3, 3 *a*, Pl. CLIV., Part XII., 373.
—— *cucullatus*, Fig. 5, Pl. CLV., Part XII., 407.
—— (Cycloryx), Part XII., 334, 369.
—— (——) *bembex*, Figs. 1, 1 *a*, Pl. CXLVII., Part XII., 346.
—— (——) *burrailensis*, Figs. 6, 6 *a*, Pl. CXLVII., Part XII., 403.
—— (——) *constrictus*, Figs. 4, 4 *a*, Pl. CXLVII., Part XII., 347; Figs. 1, 1 *a*, Pl. CLIV., Part XII., 348.
—— (——) *costatus*, Figs. 2, 2 *a*, Pl. CLIV., Part XII., 360.
—— (——) *difficilis*, Figs. 2, 2 *a*, Pl. CLV., Part XII., 415.
—— (——) *elegans*, Fig. 9, Pl. CXLVII., Part XII., 361.
—— (——) *granum*, Fig. 6, Pl. LXIII., Part XII., 364.
—— (——) *graphicus*, Figs. 1–1 *b*, Pl. CXLVI., Part XII., 419.
—— (——) ——, var., Part XII., 361.
—— (——) ——, var. *dihingensis*, Figs. 6, 6 *a*, Pl. CXLVI., Part. XII., 363, 404.
—— (——) ——, var. *variabilis*, Fig. 4, Pl. CXLVI., Part XII., 403.
—— (——) *khunhoensis*, Fig. 8, Pl. CXLVII., Part XII., 403.
—— (——) *mangutensis*, Figs. 5, 5 *a*, Pl. CXLVI., Part XII., 377.
—— (——) *multicostulatus*, Fig. 7, Pl. CXLVII., Part XII., 404.
—— (——) *otiphorus*, Figs. 2–2 *b*, Pl. CXLVII., Part XII., 349.
—— (——) *summus*, Figs. 3, 3 *a*, Pl. CXLVII., Part XII., 349.
—— (——) *spratti*, Figs. 10, 10 *a*, Pl. CLI., Part XII., 417.
—— (——) *tenellus*, Figs. 3, 4, 4 *a*, Pl. CLV., Part XII., 417.
—— (——) *thompsoni*, Figs. 3, 3 *a*, Pl. CXLVI., Part XII., 404.
—— *daflaensis*, Figs. 11–11 *b*, Pl. CXLV., Part XII., 354.
—— *dalingensis*, Figs. 3–3 *c*, Pl. CXXXIV., Part XII., 338.
—— *davisi*, Figs. 9, 9 *a*, Pl. CLVIII., Part XII., 408.
—— *diagonius*, Figs. 5–5 *b*, Pl. XLIII., Part XII., 389.
—— *digitatus*, Figs. 5, 5 *a*, Pl. CXXXIV., Part XII., 339.
—— *dikrangensis*, Figs. 6, 6 *a*, Pl. CXLVIII., Part XII., 355.
—— (Dioryx), Part XII., 345.
—— (——) *amphora*, Figs. 11–11 *b*, Pl. CLIII., Part XII., 429.
—— (——) *cochinensis*, Figs. 7, 7 *a*, Pl. CLVI., Part XII., 428.
—— (——) *feddenianus*, Fig. 12, Pl. CLIII., Part XII., 415.
—— (——) *globulosus*, Figs. 1, 1 *a*, Pl. CLVII., Part XII., 368.

Alycæus (Dioryx) *graphicus*, var. *minor*, Figs. 9, 9 *a*, Pl. CXLIV., Part XII., 403.
—— (——) *labrirubidum*, Figs. 1, 1 *a*, Pl. CLV., Part XII., 430.
—— (——) *margarita*, Part XII., 416.
—— (——) *pingoungensis*, Figs. 13, 13 *a*, Pl. CLIII., Part XII., 414.
—— (——) *urceolus*, Figs. 9, 9 *a*, Pl. CLIII., Part XII., 369.
—— (——) *urnula*, Figs. 1, 1 *a*, Pl. CLIII., Part XII., 345.
—— (——) ——, var. *anghamiensis*, Figs. 6, 6 *a*, Pl. CLIII., Part XII., 402.
—— (——) ——, var. *daflaensis*, Fig. 4, Pl. CLIII., Part XII., 360.
—— (——) ——, var. *globosus*, Fig. 8, Pl. CLIII., Part XII., 363.
—— (——) ——, var. *pisum*, Figs. 3, 3 *a*, Pl. CLIII., Part XII., 384, 402, 414.
—— (——) *varius*, Figs. 7, 7 *a*, Pl. CLVII., Part XII., 402.
—— *dohertyi*, Part XII., 408; Figs. 3, 3 *a*, Pl. LXIII., Part VII., 3.
—— *duoculmen*, Figs. 2, 2 *a*, Pl. CLVII., Part XII., 365.
—— *duorugosus*, Part XII., 391.
—— *distinctus*, Figs. 2–2 *b*, Pl. CXXXVII., Part XII., 363; Figs. 3–3 *b*, Pl. CXLV., Part XII., 390.
—— ——, var., Fig. 4, Pl. CXLIX., Part XII., 391.
—— ——, var., Part XII., 391.
—— *edei*, Figs. 2, 2 *a*, Pl. CXLIX., Part XII., 391.
—— *expatriatus*, Part XII., 433.
—— *footei*, Part XII., 432.
—— *gemma*, Figs. 6, 6 *a*, Pl. CXLIX., Part XII., 355.
—— *generosus*, Figs. 8–8 *b*, Pl. CXXXVIII., Part XII., 374.
—— *glaber*, Fig. 1, Pl. CLI., Part XII., 418.
—— *globulus*, Figs. 4–4 *b*, Pl. CXLIV., Part XII., 392.
—— *granum*, Fig. 6, Pl. LXIII., Part VII., 4.
—— *graphiarius*, Figs. 7, 7 *a*, Pl. CXLVI., Part XII., 416.
—— *graphicus*, var., Part XII., 416.
—— *habiangensis*, Figs. 2–2 *b*, Pl. CXXXVIII., Part XII., 374.
—— *hebes*, Figs. 5–5 *b*, Pl. CXLV., Part XII., 374.
—— *humilis*, Fig. 8, Pl. CLI., Part XII., 408.
—— *inflatus*, Figs. 1 *b*–1 *d*, Pl. CXLIV., Part XII., 392.
—— ——, var., Figs. 1, 1 *a*, Pl. CXLIV., Part XII., 393.
—— *ingrami*, Figs. 1–1 *c*, Pl. XLIV., Part XII., 421.
—— *jaintiacus*, Figs. 3–3 *b*, Pl. CXLIII., Part XII., 375.
—— ——, var. *crassus*, Figs. 5, 5 *a*, Pl. CXXXVII., Part XII., 375.
—— *kamakiaensis*, Fig. 8, Pl. CXLI., Part XII., 375.
—— *kengtungensis*, Figs. 6, 6 *a*, Pl. CXXXIX., Part XII., 409.
—— *kezamaensis*, Fig. 1, Pl. CXLIX., Part XII., 393.
—— *khasiacus*, Part XII., 356, 393; Figs. 7–7 *b*, Pl. CLXIII., Part XII., 376.

Alycæus *khasiacus*, var., Part XII., 356.
—— *kurzianus*, Figs. 7, 7 *a*, Pl. CLI., Part XII., 409.
—— *lahupaensis*, Figs. 3, 3 *a*, Pl. CXLI., Part XII., 394.
—— *lectus*, Figs. 5–5 *b*, Pl. CXXXVI., Part XII., 340.
—— *lenticulus*, Figs. 2, 2 *a*, Pl. CXXXVI., Part XII., 340.
—— *levis*, Figs. 3, 3 *a*, Pl. CXXXVIII., Part XII., 394.
—— *logtakensis*, Fig. 6, Pl. CLV., Part XII., 394.
—— *lohitensis*, Figs. 1, 1 *a*, Pl. CXXXVII., Part XII., 362.
—— *lugorensis*, Figs. 6, 6 *a*, Pl. CLVII., Part XII., 365.
—— *macgregori*, Figs. 2–2 *b*, Pl. CXLI., Part XII., 356.
—— *magnus*, Figs. 1, 1 *a*, Pl. CXXXVIII., Part XII., 395.
—— *montanus*, Figs. 3, 3 *a*, Pl. CXXXVI., Part XII., 341.
—— *multirugosus*, Figs. 7, 7 *a*, Pl. CXLIV., Part XII., 395.
—— *mundulus*, Fig. 8, Pl. CXLIX., Part XII., 357.
—— *muspratti*, Fig. 1, Pl. CXLVIII., Part XII., 396.
—— *mutatus*, Figs. 9, 9 *a*, Pl. CXLV., Part XII., 357.
—— *nagaensis*, Figs. 2–2 *b*, Pl. CLXIII., Part XII., 396.
—— *nattoungensis*, Figs. 15, 15 *a*, Pl. CLV., Part XII., 410.
—— *neglectus*, Fig. 5, Pl. CLIV., Part XII., 358.
—— *nitidus*, Figs. 4, 4 *a*, Pl. CLI., Part XII., 421.
—— *nongtungensis*, Figs. 5, 5 *a*, Pl. CXXXVIII., Part XII., 378.
—— *notatus*, Figs. 8, 8 *a*, Pl. CXLV., Part XII., 358.
—— *notus*, Fig. 12, Pl. CLV., Part XII., 411.
—— *nowgongensis*, Figs. 4–4 *b*, Part XII., 397.
—— *obscurus*, Figs. 9, 9 *a*, Pl. CLIV., Part XII., 378.
—— *ochraceus*, Part XII., 411 ; Figs. 7–7 *b*, Pl. LXIII., Part VII., 3.
—— *oglei*, Fig. 2, Pl. CXLVII., Part XII., 362.
—— *omissus*, Fig. 13, Pl. CLV., Part XII., 411.
—— (Orthalycæus) *gibbus*, Figs. 5, 5 *a*, Pl. CLVI., Part XII., 427.
—— *pachitaensis* type, Part XII., 359.
—— *paucicostatus*, Figs. 5, 5 *a*, Pl. CXLVII., Part XII., 361.
—— *panggiana*, Figs. 3, 3 *a*, Pl. CLVI., Part XII., 367.
—— *peilei*, Preston, Part XII., 397.
—— *perplexus*, Fig. 11, Pl. CLV., Part XII., 380.
—— *plectocheilus*, Figs. 4–4 *c*, Pl. CXXXIV., Part XII., 342 ; large var., Figs. 3–3 *c*, Pl. CXXXIII., Part XII., 343.
—— *physis*, Figs. 1, 1 *a*, Pl. CXXXIV., Part XII., 342.
—— *politus*, Figs. 5, 5 *a*, Pl. CXXXIX., Part XII., 422.
—— *polygonoma*, Fig. 5, Pl. CXLI., Part XII., 423.
—— *prosectus*, Figs. 1–1 *b*, Pl. CXLIII., Part XII., 380 ; var., Part XII., 381.
—— *pusillus*, Figs. 6–6 *b*, Pl. CXLIII., Part XII., 379 ; Part XII., 398.

Alycæus *pyramidalis*, Figs. 6, 6 *a*, Pl. CLV., Part XII., 427.
—— (Raptomphalus), Part XII., 366.
—— (——) *magnificus*, Figs. 1–1 *b*, Pl. CLVI., Part XII., 366.
—— *rechilaensis*, Figs. 2, 2 *a*, Pl. CXXXIV., Part XII., 343.
—— *reinhardti*, Part XII., 431.
—— *richthofeni*, Fig. 9, Pl. CLI., Part XII., 426.
—— *rotundatus* type, Fig. 6, Pl. CLIV., Part XII., 359.
—— *rubinus*, Figs. 2, 2 *a*, Pl. LXIII., Part VII., 3; Part XII., 412.
—— *rugosus*, Figs. 7, 7 *a*, Pl. CXLI., Part XII., 359.
—— *sandowayensis*, Figs. 4, 4 *a*, Pl. CXXXIX., Part XII., 423.
—— *sculptilis*, Part XII., 398; Figs. 7, 7 *a*, Pl. CXXXIX., Part XII., 412; Fig. 8, Pl. CLV., Part XII., 412.
—— *sculpturus*, Figs. 6–6 *b*, Pl. CXLV., Part XII., 398.
—— *serratus*, Figs. 6–6 *b*, Pl. CXLIV., Part XII., 400.
—— *sibbumensis*, Figs. 4, 4 *a*, Pl. CLVI., Part XII., 367.
—— *stoliczkii*, Figs. 3–3 *b*, Pl. CXLIV., Part XII., 399.
—— *strangulatus*, Figs. 1, 1 *a*, Pl CXXXVI., Part XII, 337.
—— *strigatus*, Figs. 2–2 *b*, Pl. CXLIV., Part XII., 381; Part XII., 401.
—— *subculmen*, Figs. 4, 4 *a*, Pl. LXIII., Part VII., 4; Part XII., 398.
—— *subinflatus*, Figs. 8, 8 *a*, Pl. CLIV., Part XII., 400.
—— *succineus*, Fig. 2, Pl. CLI., Part XII., 424.
—— *stylifer*, Figs. 2–2 *c*, Pl. CXXXIII., Part XII., 344.
—— *sylheticus*, Figs. 4, 4 *a*, Pl. CLIV., Part XII., 382.
—— *tanghali*, Figs. 3–3 *b*, Pl. CXXXVIII., Part XII., 401.
—— *teriaensis*, Figs. 10, 10 *a*, Pl. CLIV., Part XII., 382.
—— *theobaldi*, Figs. 4, 4 *a*, Pl. CXLV., Part XII., 382.
—— ——, var. *diyungensis*, Fig. 4, Pl. CXXXVIII., Part XII., 401.
—— ——, var. *solidus*, Fig. 10, Pl. CLV., Part XII., 383.
—— *toruputuensis*, Part XII., 359; Figs. 3–3 *b*, Pl. CXLIX., Part XII., 360.
—— *umbonalis*, Figs. 2–2 *c*, Pl. XLIV., Part XII., 413; Figs. 2–2 *b*, Pl. XLIV., Part XII., 424.
—— *urnula*. large var., Fig. 2, Pl. CLIII., Part XII., 346.
—— *vesica*, Fig. 10, Pl. CXLIX., Part XII., 368.
—— *vestitus*, Figs. 2, 2 *a*, Pl. CXXXIX., Part XII., 424.
—— ——, var. *akyabensis*, Fig. 7, Pl. CLV., Part XII., 425.
—— *vulcani*, Figs. 5, 5 *a*, Pl. CLI., Part XII., 413.
—— *woodthorpi*, Fig. 14, Pl. CLV., Part XII., 414.
—— *yamnayensis*, Fig. 2, Pl. CLVI., Part XII., 368.

ARIOPHANTA, 81, 82.

Ariophanta *dalyi*, Fig. 4, Pl. XCVIII., Part IX., 128.
—— *lævipes*, Figs. 5–5 *c*, Pl. LXXX., Part VIII., 81; (spermatophore), Fig. 5 *b*, Pl. LXXX., Part IX., 135.

AUSTENIA, 50, 108, 170, 272, 286.

Austenia *annandalei*, Figs. 15, 15 *a*, Pl. CXXVIII., Part XI., 288; Figs. 1–1 *d*, Pl. CXXX., Part XI., 288.
—— *butleri* (spermatophore), Fig. 10, Pl. XC., Part IX., 133.
—— *durrangensis*, Figs. 5–5 *b*, Pl. CVIII., Part X., 172; Figs. 7–7 *c*. Pl. CXI., Part X., 172.
—— *gigas* (spermatophore), Figs. 1–3, Pl. XC., Part IX., 133.
—— *gurhwalensis*, Figs. 1–1 *h*, Pl. XCI., Part IX., 108.
—— *paurhiensis*, Figs. 2–2 *c*, Pl. XCI., Part IX., 109.
—— *planospira*, Figs. 1–5 *d*, Pl. XXXVI., Part IV., 149; Figs. 1–1 *b*, Pl. XXXVIII., Part VIII., 50.
—— *resplendens*, Figs. 2–2 *f*, Pl. CXXX., Part IX., 286.
—— *rotunda*, Figs. 4–4 *f*, Pl. CXXX., Part XI., 290.
—— *shanensis* (spermatophore), Fig. 3 *c*, Pl. XCI., Part IX., 133.
—— *silcharensis*, Figs. 1–3 *a*, Pl. CVII., Part X., 170.
—— *zemoensis*, Figs. 4–9, Pl. CVII., Part X., 171.

## B.

BENSONIA, 115, 147.

Bensonia *camura*, Figs. 1–7, Pl. CI., Part X., 147.
—— *jacquemonti* ?, Part IX., 117.
—— ——, var. *kurramensis*, Figs. 1–1 *i*, Pl. XCV., Part IX., 115.
—— *labiata* (spermatophore), Figs. 5 *e*–5 *g*, Pl. LXI., Part IX., 133.
—— *wynnei*, Figs. 2–2 *b*, Pl. XCV., Part IX., 118.

## C.

CATHAICA, 329.

Cathaica *hookeri*, Figs. 1–1 *h*, Pl. CLII., Part XII., 329.

CRYPTAUSTENIA, 277.

Cryptaustenia *bensoni*, Figs. 10, 10 *a*, Pl. CXXIII., Part XI., 278; Figs. 5–5 *b*, Pl. CXXIV., Part XI., 278.

Cryptaustenia *helva*, Figs. 4, 4 *a*, Pl. CXXV., Part XI., 283.
—— *heteroconcha*, Figs. 3, 3 *a*, Pl. CXXX., Part XI., 279; Fig. 14, Pl. CXXXVIII., Part XI., 279.
—— *moyongensis*, Figs. 2–2 *c*, Pl. CXIX., Part XI., 281; Figs. 6–6 *f*, Pl. CXXII., Part XI., 281.
—— *nongsingriensis*, Figs. 5, 5 *a*, Pl. CXXV., Part XI., 282.
—— *ovata*, Figs. 11, 11 *a*, Pl. CXXIII., Part XI., 279.
—— *ovum*, Figs. 3, 3 *a*, Pl. CXXV., Part XI., 282.
—— *rarhiensis*, Figs. 2, 2 *a*, Pl. CXXV., Part XI., 282.
—— *salius*, Fig. 1, Pl. XXXVII., Part XI., 278.
—— *sicharensis*, Figs. 1, 1 *a*, Pl. CXXV., Part XI., 281.

CRYPTOSOMA, 50, 291.

Cryptosoma *imperator*, Figs. 1–6 *a*, Pl. LXXII., Part VIII., 53.
—— *insusitatum*, Figs. 1–8, Pl. LXX., Part VIII., 51; Part IX., 134.
—— *khyoungensis*, Part XI., 291.
—— *siamense*, Figs. 1–5, Pl. LXXI., Part VIII., 52.

Fam. **CYCLOPHORIDÆ**, 2, 17, 332.

Fam. **CYCLOSTOMIDÆ**, 25.

*CYCLOSTOMACEA*, 25.

CYCLOSTOMA, 32.

Cyclostoma *elegans*, Part VII., 32.

CYCLOPHORUS, 17.

CYCLOHELIX, 23.

Cyclohelix *crocatus*, Figs. 5–8, Pl. LXVIII., Part VII., 24.

**D.**

DALINGIA, 149.

Dalingia *bhutanensis*, Figs. 1–6, Pl. CII., Part X., 149.

DAMAYANTIA, 55.

Damayantia *dilecta*, Figs. 1–7 *d*, Pl. LXXIII., Part VIII., 55.

DEKHANIA (Vol. I., 243), 113.

## DIPLOMMATINÆ, 5.

### DIPLOMMATINA, 5.

Diplommatina *ambigua*, Fig. 2, Pl. LXIV., Part VII., 8.
—— *animula*, Fig. 2, Pl. LXVI., Part VII., 12.
—— *butleri*, Fig. 9, Pl. LXIV., Part VII., 6.
—— *chennelli*, Figs. 8, 8 *a*, Pl. LXIV., Part VII., 6.
—— *commutata*, Fig. 4, Pl. LXIV., Part VII., 8.
—— *compacta*, Figs. 7–7 *b*, Pl. LXV., Plate VII., 11.
—— *concinna*, Fig. 10, Pl. LXVI., Part VII., 15.
—— *decorosa*, Fig. 1, Pl. LXIV., Part VII., 5.
—— *delicata*, Fig. 5, Pl. LXVI., Part VII., 13.
—— *distincta*, Figs. 4–4 *b*, Pl. LXV., Part VII., 10.
—— *dohertyi*, Figs. 1, 1 *a*, Pl. LXV., Part VII., 9.
—— *domuncula*, Fig. 8, Pl. LXVI., Part VII., 15.
—— *elongata*, Fig. 6, Pl. LXIV., Part VII., 7.
—— *garoensis*, Figs. 3, 3 *a*, Pl. LXIV., Part VII., 8.
—— *gibberosa*, Figs. 12, 12 *a*–12 *c*, Pl. LXVI., Part VII., 16.
—— *japvoensis*, Figs. 11, 11 *a*, Pl. LXV., Part VII., 12.
—— *jatingana*, Figs. 8, 8 *a*, Pl. LXV., Part VII., 11.
—— *khunhoensis*, Fig. 5, Pl. LXV., Part VII., 10.
—— *lapillus*, Figs. 6, 6 *a*, Pl. LXV., Part VII., 11.
—— *munipurensis*, Fig. 6, Pl. LXVI., Part VII., 14.
—— *nengloensis*, Figs. 3, 3 *a*, Pl. LXV., Part VII., 10.
—— *nicobarica*, Part VII., 16.
—— ——, var. *battemalvensis*, Part VII., 16.
—— *subrubella*, Figs. 3, 3 *a*, Pl. LXVI., Part VII., 13.
—— *subtilis*, Figs. 4, 4 *a*, Pl. LXVI., Part VII., 13.
—— *succinea*, Fig. 9, Pl. LXVI., Part VII., 15.
—— *thomsoni*, Figs. 2, 2 *a*, Pl. LXV., Part VII., 9.
—— *tumida*, var., Fig. 7, Pl. LXIV., Part VII., 7.
—— *unicrenata*, Fig. 1, Pl. LXVI., Part VII., 12.
—— *venustula*, Figs. 7, 7 *a*, Pl. LXVI., Plate VII., 14.

## DURGELLINÆ, 60, 205, 292, 328.

### DURGELLA, 60, 205, 292, 328.

Durgella *assamica*, Figs. 1–6, Pl. LXXVII., Part VIII., 63.
—— *christianæ*, Figs. 1–5, Pl. LXXIX., Part VIII., 65.
—— *dekhanensis*, Figs. 1–5, Pl. LXXVIII., Part VIII., 68.

Durgella *edeana*, Fig. 12, Pl. CXXIII., Part XI., 292; Figs. 2, 2 *a*, Pl. CXXIX., Part XI., 292.
—— *erratica*, Figs. 2, 2 *a*, Pl. CXXXI., Part XI., 292.
—— *levicula*, Figs. 1–1 *b*, Pl. LXXVI., Part VIII., 61.
—— *levidensis*, Figs. 6–9, Pl. LXXVIII., Part VIII., 68.
—— *mairangensis*, Figs. 7–11, Pl. LXXVII., Part VIII., 64.
—— *naharaniensis*, Figs. 2–2 *c*, Pl. CXXXV., Part XII., 328.
—— *rogersi*, Figs. 4, 4 *a*, Pl. CXV., Part X., 205; Figs. 7, 7 *a*, Pl. CXVI., Part X., 205.
—— *sumbaensis*, Figs. 6–8 *b*, Pl. LXXIX., Part VIII., 66.

## E.

**EUDODONTIDÆ,** 187, 300.

*EUAUSTENIÆ*, 273.

EUAUSTENIA, 273, 274.

Euaustenia *cassida*, Fig. 1, Pl. CXXIV., Part XI., 274.
—— *lumsdeni*, Figs. 1, 1 *a*, Pl. CXXIII., Part XI., 276.
—— *scutella*, Figs. 3–3 *b*, Pl. CXXIV., Part XI., 275; Figs. 4–4 *d*, Pl. CXXIV., Part XI., 275.

EULOTA, 329.

EUPLECTA, 96, 186, 299.

Euplecta *binoyaensis*, Figs. 1–1 *d*, Pl. XCVII., Part IX., 103; Figs. 1 *b*, 1 *c*, Pl. XCVII., Part IX., 135.
—— *gardeneri*, Part XI., 299.
—— *hyphasma*, Figs. 1, 1 *a*, Pl. CXIV., Part X., 186.
—— *partita*, Figs. 1–1 *e*, Pl. LXXXVII., Part IX., 98.
—— *partita* (spermatophore), Figs. 1 *a*–1 *c*, Pl. LXXXVII., Part IX., 135.
—— *phideas*, Part XI., 299.
—— *præemineus*, Figs. 1–7, Pl. LXXXVI., Part IX., 100.
—— *semidecussata*, Figs. 2–2 *d*, Pl. XCVII., Part IX., 101.
—— *shiplayi* ?, Part IX., 102.

EURYCHLAMYS, 90, 283.

Eurychlamys *blanfordi*, Fig. 2, Pl. CXXVII., Part XI., 284.
—— *platychlamys*, Figs. 1–1 *e*, Pl. LXXXIV., Part IX., 90.
—— *regulata*, Figs. 2 *a*–2 *g*, Pl. LXXXIV., Part IX., 92.
—— *todarum*, Figs. 1–1 *d*, Pl. CXXVII., Part XI., 285.

## G.

GIRASIA, 104, 290.

Girasia *hookeri*, Pl. LXXXVIII., Vol. I., Part IX., 104, 219, 220; (spermatophore), Figs. 1–1 *b*, Pl. LXXXVIII., Part IX., 133.
—— *shanensis*, Figs. 3–3 *e*, Pl. XCI., Part IX., 107.

## H.

HAUGHTONIA, 120.

Haughtonia *conferta*, Figs. 1–8, Pl. XCIX., Part IX., 120.

HELICARIONINÆ, 276.

**HELICIDÆ**, 329.

Helix (Endodonta) *rotundus*, Fig. 8, Pl. CLVIII., Part XII., 331.
—— *lubrica*, Fig. 9, Pl. VIII., Part X., 183.
—— (Vallonia ?) *humilis*, Fig. 1, Pl. CLVIII., Part XII., 330.

HEMIPLECTA, 70.

Hemiplecta *humphreysiana*, Figs. 6–6 *b*, Pl. LXXX., Part VIII., 74; Figs. 1–1 *e*, Pl. LXXXI., Part VIII., 74.
—— *uter*, Figs. 1–1 *d*, Pl. LXXXII., Part VIII., 77.

HYALINIA, 317.

## I.

IBYCUS, 209.

## K.

KALIELLA, 48, 326.

Kaliella, Figs. 2–12, Pl. CIII., Part X., 174.
—— *bhutanensis*, Figs. 7, 7 *a*, Pl. CIII., Part X., 176.
—— *flatura*, Fig. 3, Pl. CIII., Part X., 176.
—— *henzadaensis*, Fig. 11, Pl. CLVIII., Part XII., 326.
—— *jaintiaca*, Figs. 8, 8 *a*, Pl. CIII., Part X., 174.

Kaliella *kezamaensis* (spermatophore), Fig. 11, Pl. XL., Part IX., 134.
—— *minutissima*, Fig. 7, Pl. CLVIII., Part XII., 326.
—— *nagaensis*, Part I., 9; Fig. 11, Pl. II., Part X., 174.
—— *nana*, Part II., 21; Figs. 6, 6 *a*, Pl. V., Part VIII., 47.
—— *paucistriata*, Fig. 10, Pl. CIII., Part X., 174.
—— *radicita*, Fig. 12, Pl. CLVIII., Part XII., 327.
—— *richilaensis*, Figs. 2, 2 *b*, Pl. CIII., Part X., 175.
—— ——, var., Fig. 2 *a*, Pl. CIII., Part X., 175.
—— *rissomensis*, Fig. 9, Pl. CIII., Part X., 174.
—— *shillongensis*, Fig. 5, Pl. CIII., Part X., 176.
—— *sikkimensis*, Fig. 4, Pl. CIII., Part X., 175.
—— *tholus*, Fig. 10, Pl. CLVIII., Part XII., 326.

KASPERIA, 312.

Kasperia *mayæ*, Figs. 1–12, Pl. CXL., Part XII., 312.

KHASIELLA, 129.

Khasiella *vidua*, Figs. 1–5 *d*, Pl. C., Part IX., 130.

**L.**

LAMPROCYSTIS.

Lamprocystis ? *fulgida*, Figs. 3–3 *f*, Pl. CXV., Part X , 214; Figs. 6, 6 *a*, Pl. CXVI., Part X., 214.

LEPTODONTARION, 207, 293.

Leptodontarion *hiraseanus*, Figs. 1–1 *b*, Pl. CXV., Part X., 208; Figs. 4–4 *d*, Pl. CXVI., Part X., 208.
—— *tavoyensis*, Figs. 3–3 *e*, Pl. CXXVII., Part XI., 293.

**LIMACIDÆ**, 312.

LIMAX, 312.

**M.**

**MACROCHLAMYINÆ**, 240, 322.

MACROCHLAMYS, 48, 87, 136, 151, 240, 241, 322, 324.

Macrochlamys *andersoniana*, Figs. 10–10 *c*, Pl. CXIX., Part XI., 254; Figs. 11, 11 *a*, Pl. CXXI., Part XI., 254.
—— *angigyrata*, Fig. 11, Pl. CXXXI., Part XI., 265; Fig. 8, Pl. CXXXII., Part XI., 265.

Macrochlamys *anonæ*, Part III., 91; Fig. 8, Pl. XIV., Part VIII., 48.
—— *beata*, Figs. 1–1 *b*, Pl. CVIII., Part X., 156; Figs. 6–6 *c*, Pl. CXXV., Part XI., 263.
—— *bilineata*, Fig. 9, Pl. CXXVI., Part XI., 259.
—— *cacharica*, var. *glauca*, Fig. 5, Pl. CXXI., Part XI., 253.
—— *causia*, Part X., 163.
—— *chaos*, Fig. 2, Pl. CXXVIII., Part XI., 268.
—— *choinix*, Part IV., 102; Figs. 6, 6 *a*, Pl. XXII., Part VIII., 48.
——, var. *gigantea*, Part VIII., 48.
—— *cinctula*, Fig. 9, Pl. CXXI., Part XI., 253.
—— *damsangensis*, Figs. 2–2 *f*, Pl. CV., Part X., 155.
—— *decursus*, Fig. 3, Pl. CL., Part XII., 324.
—— *dikrangensis*, Fig. 5, Pl. CXXXI., Part XI., 267.
—— *evidens*, Fig. 11, Pl. CXXVI., Part XI., 260.
—— *extraria*, Fig. 4, Pl. CXXVIII., Part XI., 252.
—— *exul*, Figs. 2–2 *d*, Pl. CXI., Part X., 165.
—— *flemingi* (spermatophore), Figs. 2–2 *d*, Pl. LXXXVII., Part IX., 133.
—— *formosana*, Part X., 214.
—— *fragosus*, Fig. 4, Pl. CIX., Part X., 161.
—— *fulgens*, Fig. 8, Pl. CXVII., Part X., 215.
—— *ganjamensis*, Figs. 4, 5, Pl. CXXIII., Part XI., 268.
—— *garoensis*, Fig. 3, Pl. CXXI., Part XI., 258.
—— *glauca*, Figs. 5, 5 *a*, Pls. CXXIX., Part XI., 246; Fig. 10, Pl. XXVIII., Part XI., 246.
—— *hardwickei*, Part XI., 264.
—— *heugdanensis*, Figs. 4–4 *b*, Pl. CVIII., Part X., 158.
—— *herbia*, Figs. 2, 2 *a*, Pl. CXXIII., Pt. XI., 262.
—— *hodgsoni*, Figs. 1, 1 *a*, 2–2 *d*, Pl. CIX., Part X., 159.
—— *honesta* (spermatophore), Fig. 13, Pl. XVII., Part IX., 134.
—— *hookeri*, Figs. 10, 10 *a*, Pl. CIX., Part X., 163.
—— *hyalinoidea*, Fig. 11, Pl. CXXVIII., Part XI., 272.
—— *indica*, var., Fig. 3, Pl. CXXXI., Part XI., 264.
—— *jainiana* (spermatophore), Figs. 2 *b*–2 *e*, Pl. XXVIII., Part IX., 134.
—— *japvoensis*, Fig. 5, Pl. CXXVI., Part XI., 261.
—— *kala* (spermatophore), Figs. 6, 7, Pl. XL., Part IX., 135.
—— *kashmirensis*, Figs. 2–2 *b*, Pl. CL., Part XII., 322.
—— *koliaensis*, Part IV., 119; Figs. 5, 5 *a*, Pl. XXVI., Part VIII., 50.
—— *kuluensis*, Fig. 12, Pl. CXXVIII., Part XI., 246; Fig. 7, Pl. CXXIX., Part XI., 246.
—— *kumahensis*, Fig. 8, Pl. CXXIII., Part XI., 270; Fig. 8, Pl. CXXVIII., Part XI., 271.
—— *kurtzi*, Figs. 4, 4 *a*, Pl. CXXI., Part XI., 252.
—— *lahupaensis*, Part X., 159; Figs. 3, 3 *a*, Pl. CXXVI., Part XI., 259.

Macrochlamys *lecythis* (spermatophore), Figs. 2, 2 *a*, Pl. XCIV., Part IX., 134.
—— *lhotaensis*, Part IV., 107, Fig. 5, Pl. XXIII.; Part VIII., 49.
—— *lubricata*, Fig. 10, Pl. CXXI., Part XI., 257; Figs. 6, 6 *a*, 11–11 *b*, Pl. CXXIX., Part XI., 257.
—— *mahadeonsis*, Figs. 3–3 *b*, Pl. CVIII., Part X., 157.
—— *masoni*, Fig. 6, Pl. CXXXI., Part XI., 247.
—— *microcystis ? sonamurgensis*, Part XII., 323.
—— *munipurensis*, Part X., 158; Fig. 8, Pl. CXXVI., Part XI., 260.
—— *nemothaensis*, Fig. 7, Pl. CXXVI., Part XI., 261.
—— *pedina*, Figs. 1–5 *c*, Pl. LXXXIII., Part VIII., 87; (spermatophore), Figs. 5–5 *c*, Pl. LXXXIII., Part IX., 133.
—— ? *perfragilis*, Fig. 5, Pl. CIX., Part X., 161.
—— *politula*, Figs. 3–3 *d*, Pl. CXX., Part XI., 265.
—— *proba*, Fig. 7, Pl. CXXI., Part XI., 258.
—— *prona*, Part IV., 103, 111; Figs. 2, 2 *a*, Pl. XXII., Part VIII., 48.
—— *propinqua*, Figs. 3, 3 *a*, Pl. CXXIII., Part XI., 263.
—— *pumicata*, Part X., 181.
—— *quæsita*, Figs. 12–12 *b*, Pl. CXIX., Part XI., 263.
—— *rabani*, Fig. 6, Pl. CXXI., Part XI., 258.
—— *radia*, Figs. 9, 9 *a*, Pl. CXXVIII., Part XI., 245.
—— *rakaensis*, Figs. 2–2 *b*, Pl. CX., Part X., 164; Figs. 1, 1 *a*, Pl. CXXVIII., Part XI., 269.
—— *razamiensis*, Figs. 2–2 *b*, Pl. CVIII., Part X., 157.
—— *renitens*, Fig. 4, Pl. CXXXI., Part XI., 305.
—— *resplendens*, Part IV., 109; Fig. 1, Pl. XXVI., Part VIII., 49.
—— *richilaensis*, Figs. 1–1 *g*, Pl. CV., Part X., 154.
—— *rorida*, Figs. 3–3 *b*, Pl. CIX., Part X., 160.
—— *sacrata*, Fig. 3, Pl. CXXVIII. (shell), Part XI., 244; Fig. 4, Pl. CXXIX., Part XI., 244.
—— *saltus*, Figs. 2, 2 *a*, Pl. CXXVI., Part XI., 261.
—— *salwinensis*, Fig. 9, Pl. CIX., Part X., 163.
—— *sathilaensis*, Figs. 4–4 *c*, Pl. CVI., Part X., 169.
—— *scyphus*, Figs. 1, 1 *a*, Pl. CXXVI., Part XI., 260.
—— *sequax*, Figs. 1–1 *d*, 3, 3 *a*, Pl. CVI., Part X., 166.
—— *sequius*, Figs. 2–2 *g*, Pl. CVI., Part X., 168; Fig. 7, Pl. CIX., Part X., 168.
—— *silcuriensis*, Fig. 9, Pl. CLVIII., Part XII., 324.
—— ? *sonamurgensis*, Part XII., 323.
—— *sphærica*, Figs. 6, 6 *a*, Pl. CXXVI., Part XI., 262.
—— *spreta*, Figs. 8, 8 *a*, Pl. CIX., Part X., 162.
—— *stephus*, Figs. 6, 6 *a*, Pl. CXXVIII., Part XI., 269.
—— *striata*, Fig. 10, Pl. CXXVI., Part XI., 261.
—— *striaticostata*, Fig. 5, Pl. CXXXII., Part XI., 266.

Macrochlamys *sylhetensis*, Fig. 9, Pl. CXXIII., Part XI., 251.
—— *sylvatica*, Fig. 7, Pl. CXXIII., Part XI., 271.
—— *subangulata*, Fig. 4, Pl. CXXVI., Part XI., 259.
—— *subjecta*, Figs. 1–1 *b*, Pl. CXVIII., Part XI., 241, 242.
—— *subflava*, Figs. 4, 5, 7, 7 *a*, 9, Pl. CXIX., Part XI., 255, 256; Figs. 1–1 *c*, 2–2 *c*, 4, Pl. CXXII., Part XI., 256, 257; Fig. 8 (radula), Pl. CXXIX., Part XI., 255.
—— *superflua*, Part X., 162; Figs. 7–7 *b*, Pl. CXXVIII., Part XI., 268.
—— *terminalis*, Fig. 8, Pl. CXXXI., Part XI., 267.
—— *terminus* (spermatophore), Figs. 3, 3 *a*, Pl. XCIV., Part IX., 134, 136; Fig. 5, Pl. CXXVIII., Part XI., 251.
—— *tugurium*, Figs. 1–7, Pl. CIV., Part X., 151.
—— *uda* (spermatophore), Fig. 1, Pl. XCIV., Part IX., 133, 136.
—— *udus*, Figs. 13, 13 *a*, Pl. CXXVIII., Part XI., 252; Figs. 10, 10 *a*, Pl. CXXXI., Part XI., 252.
—— *vertex*, Fig. 6, Pl. CXXIII., Part XI., 262.
—— *vesica*, G.-A., Figs. 2–2 *c*, Pl. CXVIII., Part XI., 248; Figs. 3–3 *c*, Pl. CXVIII., Part XI., 248; Figs. 1–1 *c*, Pl. CXX., Part XI., 249; Figs. 5–5 *c*, Pl. CXVIII., Part XI., 249.
—— ——, var., Fig. 2, Pl. CXXI., Part XI., 251.
—— ——, var. *anomelus*, Figs. 4–4 *c*, Pl. CXVIII., Part XI., 250.
—— ——, var. *oglei*, Figs. 1–1 *c*, Pl. CXIX., Part XI., 250; Figs. 2–2 *b*, Pl. CXX., Part XI., 250; Fig. 5, Pl. CXXII., Part XI., 250.
—— *vesicula*, Figs. 1, 1 *a*, Pl. CXXI., Part XI., 243, 244.
—— ? *wynnei*, Figs. 3, 3 *a*, Pl. XCV., Part IX., 118.
—— *zemoensis*, Figs. 1–1 *h*, Pl. CX., Part X., 164.

MARIÆLLA, 113.

Mariælla *dussumieri*, Figs. 1–1 *c*, 2–2 *c*, Pl. XCIII., Part IX., 113; (spermatophore), Figs. 1 *b*, 1 *c*, Pl. XCIII., Part IX., 133.

MICROCYSTINA, 48, 110.

Microcystina *lita*, Figs. 1–1 *c*, Pl. XCII., Part IX., 111.
—— *moerchiana*, Fig. 9, Pl. III., Part I., 13; Part VIII., 47.
—— *perfucata*, Fig. 4, Pl. XCII., Part IX., 110.
——, var. *bintennensis*, Figs. 3–3 *i*, Pl. XCII., Part IX., 110.
—— *warnefordi*, Fig. 8, Pl. III., Part I., 13; Part VIII., 47.

MICROCYSTIS, 111.

Microcystis *umbræ*, Figs. 3–3 *h*, Pl. XCIII., Part IX., 111.

## N.

NATALIA, 22.

Natalia *wahlbergi*, Figs. 1, 4 *a*, Pl. LXVIII., Part VII., 22.

NILGIRIA, 77, 123.

Nilgiria *bistrialis*, Figs. 4–4 *a*, Pl. LXXXI., Part VIII., 80.
—— *ceylanica*, Part IX., 126.
—— *chenui*, Figs. 1–9, Pl. XCVI., Part IX., 124.
—— *ligulata*, Figs. 1–1 *d*, Pl. XCVIII., Part IX., 123.
—— *solata*, Figs. 1–4 *a*, Pl. LXXX., Part VIII., 77.
—— *tranquebarica*, Figs. 3–3 *d*, Pl. LXXXI., Part VIII., 78; (spermatophore), Figs. 3 *c*, 3 *d*, Pl. LXXXI., Part IX., 135.

## O.

OTOPOMA, 25, 29.

Otopoma *clathratulum*, Part VII., 30.
—— *naticoides*, Figs. 1–5 *a*, Pl. LXVII., Part VII., 29.

OXYTES, 5.

Oxytes *silvicola*, Part IV., 131 (not figured).

## P.

PARMACELLA, 314.

Parmacella (Kandaharia), Part XII., 314.
—— (——), *kojhakensis*, Figs. 1–9 *a*, Part XII., 314.

PARMARION, 57.

PARVATELLA, 319.

Parvatella *austenia*, Figs. 1–1 *f*, Pl. CL., Part XII., 319.
—— *sogdiana*, Figs. 1–1 *f*, Pl. CXXXV., Part XII., 321.

PETALOCHLAMYS, 212.

Petalochlamys *formosana*, Figs. 2–2 *b*, Pl. CXV., Part X., 213; Figs. 5–5 *b*, Pl. CXVI., Part X., 213.

PHILALANKA, 190.

Philalanka *batuensis*, Part X., 195.
—— *circumsculpta*, Part X., 194.

Philalanka *floweri*, Part X., 195.
—— *secessa*, Part X., 191.
—— *thwaitesi*, Figs. 1–1 *c*, Pl. CXII., Part X., 193.

PLECTOPYLIS, 201.

Plectopylis *pinacis*, Figs. 2–2 *d*, Pl. CXIV., Part X., 203.

PSEUDOKALIELLA, 296, 325.

Pseudokaliella *akhaensis*, Fig. 3, Pl. CLVIII., Part XII., 325.
—— *dihingensis*, Fig. 2, Pl. CLVIII., Part XII., 325.
—— *nevilli*, Fig. 12, Pl. CXXXI., Part XI., 297.
—— *ornatulus*, Figs. 9–9 *b*, Pl. CXXXI., Part XI., 297.

**PUPININÆ**, 34.

PUPINA, 34.

Pupina *artata*, Figs. 6–6 *b*, Pl. LXIX., Part VII., 38.
—— *arula*, Figs. 1, 1 *a*, Pl. LXIX., Part VII., 37.
—— *blanfordi*, Figs. 2–2 *b*, Pl. LXIX., Part VII., 41.
—— *hungerfordi*, Figs. 7, 7 *a*, Pl. LXIX., Part VII., 41.
—— *limitanea*, Figs. 4–4 *b*, Pl. LXIX., Part VII., 42.
—— *nicobarica*, Fig. 8, Pl. LXIX., Part VII., 40.
—— *peguensis*, Figs. 3–3 *d*, Pl. LXIX., Part VII., 40.
—— *tongupensis*, Figs. 5, 5 *a*, Pl. LXIX., 41.

PUPISOMA, 300.

Pupisoma *cacharica*, Fig. 4, Pl. CXXXII., Part XI., 303.
—— *evezardi*, Part XI., 301.
—— *lignicola*, Part XI., 300.
—— *longstaffi*, Figs. 3–3 *b*, Pl. CXXXII., Part XI., 303.
—— *miccyla*, Fig. 1, Pl. CXXXII., Part XI., 301.
—— *orcella*, Part XI., 301.
—— *orcula*, Part XI., 301.
—— *seriola*, Part XI., 301.

**R.**

RAHULA, 216.

Rahula *bascauda* Figs. 1, 1 *a*, 3, 3 *a*, Pl. CXVII., Part X., 218.
—— *bascaudula*, Fig. 7, Pl. CXVII., Part X., 219.
—— *corys*, Part X., text-figs. 1, 4, 5, 217, 218.
—— *daflaensis*, Fig. 5, Pl. CXVII., Part X., 220.

Rahula *lhotaensis*, Fig. 6, Pl. CXVII., Part X., 220.
—— *macropleuris*, Fig. 1, Pl. CIII., Part X., 216, text-figs. 2, 3.
—— *munipurensis*, Fig. 4, Pl. CXVII., Part X., 220.
—— *polypleuris*, Fig. 2, Pl. CXVII., Part X., 219.

RATNADVIPIA, 93–95.

Ratnadvipia *irradians*, Figs. 1–8 *a*, Pl. LXXXV., Part IX., 93.

RAVANA, 187.

RHADELLA, 322.

Rhadella *kashmirensis*, Figs. 2–2 *b*, Pl. CL., Part XII., 322.

## S.

SAGDINELLA, 43.

Sagdinella *didrichensii*, Part VII., 43.

SAKIELLA, 294.

Sakiella *fidus*, Fig. 8, Pl. CXXI., Part XI., 296.
—— *honesta*, Fig. 12, Pl. CXXI., Part XI., 294.
—— *merguiensis*, Figs. 1–1 *d*, Pl. CXXIX., Part XI., 295; Fig. 16, Pl. CXXVIII., Part XI., 295.

SARIKA, 179, 297.

Sarika *dohrniana*, Part X., 181.
—— *resplendens*, Figs. 3, 3 *a*, Pl. CXI., Part X., 179; Figs. 2–2 *b*, Pl. CXVI., Part X., 179.
—— *theodori*, Figs. 3–3 *c*, Pl. CXXIX., Part XI., 297, 298.

SESARA, 134.

Sesara *infrendens* (spermatophore), Fig. 7, Pl. XVI., Part IX., 134.

SITALA, 48, 327.

Sitala *balliana*, Fig. 2, Pl. XV., Part III., 74; Part VIII., 48.
—— *febrilis*, Part VIII., 48.
—— *haroldi*, Figs. 7, 7 *a*, Pl. X., Part II., 33; Part VIII., 47.
—— *pealli*, Figs. 4, 4 *a*, Pl. CL., Part XII., 328; Fig. 4, Pl. CLVIII, 328.
—— *phulongensis*, Fig. 4, Pl. X., Part II., 34; Part VIII., 48.
—— *rimicola*, Figs. 4–4 *c*, Pl. IX., Part II., 37; Part VIII., 48.
—— *subinjussa*, Fig. 5, Pl. CLVIII., Part XII., 327.
—— *vaga*, Fig. 6, Pl. CLVIII., Part XII., 327.

SOPHINA, 221.

Sophina *calias*, Part X., 224; Figs. 5, 5 *a*, Pl. CXV., Part X., 221; Fig. 3, Pl. CXVI., Part X., 221.

STAFFORDIA, 184.

Staffordia *daflaensis*, Figs. 1–1 *i*, Pl. CXIII., Part X., 185; Fig. 2, Pl. CXIII., Part X., 185.
—— *staffordia*, Fig. 4, Pl. CXIII., Part X., 185.
—— ? *toruputuensis*, Fig. 3, Pl. CXIII., Part X., 185.

SYKESIA, 196.

Sykesia *biciliata*, Figs. 3–3 *c*, Pl. CXII., Part X., 196.
—— *clathratuloides*, Part X., 199.
—— *corilla*, Part X., 199.
—— *gudei*, Figs. 3–3 *g*, Pl. CXIV., Part X., 199.

**T.**

TAPHROSPIRA, 177.

Taphrospira *bathycharax*, Figs. 1–1 *f*, Pl. CXI., Part X., 177.

**THYSANOTINÆ**, 189.

THYSANOTA, 189.

Thysanota *crinigera*, Figs. 2–2 *d*, Pl. CXII., Part X., 189.
—— *hispida*, Part X., 190.

TROPIDOPHORA, 31.

Tropidophora *betsileoensis*, Part VII., 32.

**V.**

VITRINA, 317.

Vitrina ? *baccata*, Part XII., 317.

**Z.**

**ZONITIDÆ**, 47, 60, 70, 147, 317.

ZONITOIDES, 317.

Zonitoides *notabilis*, Figs. 2, 2 *a*, Pl. CLII., Part XII., 317.

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# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA,

INCLUDING

SOUTH ARABIA, BALUCHISTAN, AFGHANISTAN, KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM, MALAY PENINSULA, CEYLON, AND OTHER ISLANDS OF THE INDIAN OCEAN.

SUPPLEMENTARY TO MESSRS. THEOBALD AND HANLEY'S

CONCHOLOGIA INDICA.

BY

LIEUT.-COLONEL H. H. GODWIN-AUSTEN,
F.R.S., F.G.S., F.Z.S., &c.,

LATE DEPUTY SUPERINTENDENT TOPOGRAPHICAL SURVEY OF INDIA, IN CHARGE OF THE KHASI, GARO, AND NAGA-HILLS SURVEY PARTY.

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## VOL. II.

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**Part VII.—OCTOBER 1897.**

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(Plates LXIII.–LXIX.—*October* 1897.)

## INTRODUCTION.

After the lapse of ten years I am able to publish another Part of this work. In this interval material has been accumulating and I have described and examined a number of species belonging to many genera found in India and the Malay Archipelago, and a large number of drawings have been made which I hope to have the opportunity of bringing out. The collection of Mr. Everett in Borneo, so kindly placed at my disposal, has given me a further insight into the interesting differences to be found and the degree of relationship shadowed forth in the species of the Zonitidæ when compared with those of India and the Malay Peninsula, and I shall introduce some of these for comparison into the work. Since 1888 I have received very much kind help from, among others, Mr. M. A. Ogle. In him I have to deplore the loss of a very dear friend and an excellent zealous assistant when serving under me in the Survey Department. He came to England for medical advice, terribly broken in health; but the best available could not save him, and he died in London on the 4th April, 1892, at the age of 50, regretted by all under whom he served, from the Surveyor-General downwards; and he rests after all his labours in our quiet country cemetery at Shalford. I look back to many pleasant days passed with him in the Assam Hills,

in many a magnificent forest, cutting our way up to the main ridges and peaks, and, while prosecuting the Survey, collecting the many interesting objects of natural history that abounded on every side. To Mr. Ogle's diligence as a collector many a new species has been added to the Indian list, both in birds and shells.

Mr. Chennell, another assistant whose name occurs often in previous parts, also fell a victim to the Survey work. To Colonel R. Woodthorpe my best thanks are also due: he has sent home many interesting shells from Gilgit, the Shan Hills, and Siam Frontier.

From the Eastern Naga Hills and Upper Burmah and Perak some interesting species were collected by Mr. William Doherty, and were kindly sent to me by Mr. T. H. Aldrich, of Cincinnati; several of these I described in the 'Proceedings' of the Zoological Society, and are figured now for the first time. This Part treats of species belonging to the genera *Alycæus*, *Diplommatina*, *Cyclophorus, Otopoma*, and *Pupina*.

---

## Family CYCLOPHORIDÆ.

### Subfamily Alycæinæ.

### Genus Alycæus (*continued from* Part V. pp. 186–196).

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### Species from the Naga Hills, Munipur, North Burmah, &c.

Alycæus bi-rugosus, Godwin-Austen. (Plate LXIII. figs. 5, 5*a*.)

*Alycæus bi-rugosus*, G.-A. P. Z. S. 1893, p. 593.

*Locality.* Khasi Hills and Munipur (*in coll. Godwin-Austen*).

*Original description*:—"Shell globosely turbinate, rather openly umbilicated; sculpture smooth on upper whorls, regular close ribbing on the swell of the last; colour pale ochraceous or ruddy brown; spire conoid, rounded at apex; suture impressed; whorls 4, the last not swollen, contracted in front of the rather short sutural tube, then enlarging again into two parallel ridges, which adjoin the aperture; aperture ovate, angular above and below, rounded on the inner margin. Operculum pale in colour, smooth in front.

"Size: maj. diam. 3·0; alt. axis 1·25 mm.

"The specimens were found in the Khasi Hills, but the exact locality is not recorded. One specimen I obtained south of the Barak River on the road from the Naga Hills to Munipur. Although this shell, in size and most of its characters, is like *A. multirugosus*, G.-A., of the Naga Hills, it differs materially, more especially in the form of the aperture and in the ridges on the expanded portion of the last whorl."

Alycæus ochraceus, Godwin-Austen. (Plate LXIII. figs. 7, 7 *a*, 7 *b*.)

*Alycæus ochraceus*, G.-A. P. Z. S. 1893, p. 594.

*Locality*. Ruby Mines District, Upper Burmah (*W. Doherty*).

*Original description*:—"Shell sub-depressedly turbinate; sculpture rather strong ribbing on the swollen part of the last whorl, on the apical whorls it is close and fine; colour ochre; spire somewhat flattened, apex blunt; suture deep; whorls 4, the last moderately swollen; sharp constriction in front of sutural tube, followed by a strong ridge which is contiguous to the crenulate peristome; aperture circular, suboblique; peristome strongly crenulated, double; operculum horny, a large central excavated circular space, surrounded by a pale ring, well marked, rising above to the marginal portion.

"Size: maj. diam. 4·5; alt. axis 1·5 mm.

"The nearest known species allied to this is *A. crenatus*, of the Khasi Hills, but the ridge behind the aperture in this last lies further back with a short interval; the peristome is not so strongly crenulate. *A. plectocheilus* of Darjiling is a much smaller form."

Alycæus dohertyi, Godwin-Austen. (Plate LXIII. figs. 3, 3 *a*.)

*Alycæus dohertyi*, G.-A. P. Z. S. 1893, p. 595.

*Locality*. Momeit, Burmah (*W. Doherty*, in coll. Aldrich).

*Original description*:—"Shell globosely turbinate, solid, not umbilicated; sculpture regular distant sharp costulation, closer and fine near the sutural tube; colour stone, with pink apex; spire rather high, conoid, rounded, apex blunt; suture impressed, the tube fine, rather long; whorls $4\frac{1}{2}$, the last swollen, constricted with a rounded ridge midway between the sutural tube and the peristome; aperture expanded, ovate; peristome double, fine sharp crenulations on the outer margin, rounded on the inner.

"Size: maj. diam. 3·25; alt. axis 2·8 mm.

"This is quite a new form, partaking in the constriction and peristome of the characters of *A. plectocheilus*, *crenatus*, &c. Momeit lies N.N.E. of Mandalay, about midway between it and Bhamo and further east than Mogok in the Ruby Mine District."

The single specimen and type figured has been sent to Mr. T. H. Aldrich, who kindly forwarded to me all the shells collected by Mr. Doherty in Burmah and Assam.

Alycæus rubinus, Godwin-Austen. (Plate LXIII. figs. 2, 2 *a*.)

*Alycæus rubinus*, G.-A. P. Z. S. 1893, p. 594.

*Locality*. Ruby Mines District, Upper Burmah (*W. Doherty*, in coll. Godwin-Austen).

*Original description*:—"Shell globosely turbinate, closely umbilicated, of thin texture, the last whorl not much swollen; sculpture very fine close ribbing adjacent to the sutural tube, rest of shell smooth, with distant fine striæ; colour olivaceous ochre; spire

conic, sides rounded; suture impressed; whorls 4, sides rounded, slightly constricted in front of the sutural tube, which is fine and moderately long; aperture oblique, circular; peristome thin, reflected, the double lips being scarcely perceptible, a slight nick on the inner upper margin.

"Size: maj. diam. 6·0; alt. axis 5·0 mm."

Two specimens were sent to me, which I have retained, as I presume Mr. Aldrich has other specimens, and they were not marked to be returned.

ALYCÆUS SUBCULMEN, Godwin-Austen. (Plate LXIII. figs. 4, 4 *a*.)

*Alycæus subculmen*, G.-A. P. Z. S. 1893, p. 593.

*Locality*. Naga Hills (*W. Doherty*, in coll. Aldrich).

*Original description*:—"Shell globosely turbinate, solid, closely perforate; sculpture, smooth on all the upper whorls and polished, close-set ribbing on the swell of the last whorl; colour dark ochraceous; spire conical, apex rounded, blunt; suture impressed; whorls 4, round, the last swollen, contracted at base of a short sutural tube, then rising into a depressed ridge, thence expanding and spreading to the aperture: aperture circular, subvertical; peristome double, much thickened, simple, continuous.

'Size: maj. diam. 2·75; alt. axis 1·5 mm.

"This is a very distinct species; in the solid rounded peristome it approaches *A. conicus* from Jaintia and *A. vestitus* from the Arakan Hills."

Eight specimens were in the collection. Two I have retained for my own collection, the type figured, and the rest have gone to Mr. Aldrich.

ALYCÆUS (DIORYX) GRANUM, Godwin-Austen. (Plate LXIII fig. 6.)

*Alycæus granum*, G.-A. P. Z. S. 1893, p. 593.

*Locality*. Margarita, foot of Eastern Naga Hills (*W. Doherty*, in coll. Aldrich).

*Original description*:—"Shell perforate, globose; sculpture fine regular ribbing, closely arranged and extending to the peristome; colour ruddy ochre; spire subconical; suture well impressed; whorls 4, rounded, a slight constriction in front of the short sutural tube; aperture suboblique, circular; peristome double, the outer reflected slightly.

"Size: maj. diam. 2·25; alt. axis 2·0 mm.

"This species is only half the size of its nearest ally, a variety of *A. otiphorus* from the wooded slopes of the North Jaintia Hills. This variety was figured and described by me in the J. A. S. B. 1871 (p. 93, pl. v. fig. 6). From Mr. Aldrich I have received three specimens of it, all fully grown, and as it is so much smaller than the typical *A. otiphorus* from Sikhim (which is as much as 4·25 mm. in maj. diam.), I consider it necessary to give it a distinct title. It is also more depressed and has fewer whorls, and the umbilical area

is more open than in the Darjiling form. The form of the Jaintia Hill shell is again so very distinct from that of the type species that I think it will be better to distinguish it as *A. granum*, var. *major*."

Alycæus busbyi, Godwin-Austen. (Plate LXIII. figs. 1, 1 *a*, 1 *b*.)

*Alycæus busbyi*, G.-A. P. Z. S. 1893, p. 595.

*Locality*. Nicobars (*G. Busby*, in coll. Dr. Hungerford).

*Original description*:—"Shell turbinate, of tumid form, widely umbilicated; sculpture smooth, fine ribbing near the sutural tube and still finer below; colour pale ochraceous; spire moderately high, apex blunt; suture deep, the sutural tube short and thick; whorls $4\frac{1}{2}$, very rounded, the last much swollen and compressed within the umbilical cavity, constriction simple, slight; aperture oblique circular; peristome double, the outer lip flat and expanding at right angles to the whorl.

"Size: maj. diam. 7·5; alt. axis 3·0 mm.

"This is the largest species as yet known from the Nicobar Islands. I name it after its discoverer, who gave the specimen to Dr. Hungerford; its exact locality has not been recorded."

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## Subfamily Diplommatininæ.

Genus Diplommatina (*continued from* Part V. pp. 166–185).

### Species from the Garo, Naga, and Munipur Hills Ranges, N.E. Frontier of India.

*Constriction in front, above the peristome; sculptured throughout.*

Diplommatina decorosa, Godwin-Austen. (Plate LXIV. fig. 1.)

*Diplommatina decorosa*, G.-A. P. Z. S. 1892, p. 510.

*Locality*. Anghami Naga Hills (*W. Doherty*, in coll. T. H. Aldrich).

*Original description*:—"Shell elongately fusiform, not rimate; sculpture, fine, close, regular costulation on all the whorls; colour pale whitish horny; spire, sides somewhat flat, apex rather acuminate, rapidly diminishing; suture moderately impressed; whorls 8, sides flatly convex, penultimate and antepenultimate equal; constriction above the aperture, towards the outer margin; aperture ovate, rounded below; peristome thickened; columellar tooth small, in front.

"Size: maj. diam. 2·5; alt. axis 5·5 mm.

"There was one solitary specimen in my collection of this species from north of the Burrail, and six specimens, but smaller in size (4·5 mm. in height of spire), from the peak of Shiroifurar, in the

Lahupa Naga Hills, north of Munipur. Mr. Aldrich's collection contains a large number, and I have selected the type out of these.

"On the remarkable boss of intrusive trap rock near the village of Phunggam I found a number of a small variety, 4·5 mm. in height of spire, but differing in no respect, except in size, from the typical species, only that they are all of a pale sea-green tint.

"The same form occurred on Kopamedza Peak, with this difference, that the constriction was more to the right, directly over the margin of the peristome. From Prowi specimens were still smaller in size, only 3·8 mm. in height of spire."

*Constriction in front, above the peristome; last whorls smooth.*

Diplommatina chennelli, Godwin-Austen. (Plate LXIV. figs. 8, 8 *a*.)

*Diplommatina chennelli*, G.-A. P. Z. S. 1892, p. 512.

*Locality.* Lhota Naga Hills (*Chennell*).

*Original description*:—"Shell dextral, of solid form; sculpture, very fine, rather distinct ribbing, with scarcely any relief; colour pale ochraceous and sienna-brown; spire flat-sided, apex acuminate; suture rather shallow; whorls $8\frac{1}{2}$ to 9, sides flatly convex, constriction in front, the last two whorls equal in size; aperture oval, vertical; peristome thickened, strong; the columellar margin vertical and angulate below.

"Size: (1st sp.) maj. diam. 2·9; alt. axis 5·9 mm.

"Size: (2nd sp.) maj. diam. 2·9; alt. axis 5·0 mm.

"This has close affinities to *D. labiosa* from the Khasi and Garo Hills; but, although far larger (nearly double), the columellar tooth is much smaller, the spire more attenuate, and the general shape differs. I name it after the late Mr. A. Chennell, an Assistant in the Indian Survey Department."

Diplommatina butleri, Godwin-Austen. (Plate LXIV. fig. 9.)

*Diplommatina butleri*, G.-A. P. Z. S. 1892, p. 512.

*Locality.* Laisen Peak, Munipur (*Godwin-Austen*).

*Original description*:—"Shell dextral, tumidly fusiform; sculpture, none on the last 3 whorls, very distant, strong costulation on all above; colour pale sienna-brown, fresh shells glassy and polished; spire conic, rapidly diminishing, apex small; suture well impressed; whorls $7\frac{1}{2}$, penultimate and antepenultimate about equal, sides very convex, constriction above the aperture; aperture nearly circular, vertical; peristome double, strong, continuous; columellar margin vertical, angulate below, the tooth large, in front.

"Size: maj. diam. 2·0; alt. axis 4·4 mm.

"Six specimens were obtained, together with those of *D. tumida*, var., previously alluded to. This well-marked species was also found by me at Prowi, in the Lahupa Naga Hills, at the head of the Lanier River, which drains into the Kyengdwen of Burmah, and was abundant there. I have also two specimens from Kezakenomih.

"Two specimens from Klang Sing, Naga Hills, are rather more tumid.

"I name this after Capt. John Butler, who was the Political Agent accompanying the Survey party on our exploring work, and who unfortunately lost his life in an ambuscade laid by a hostile clan, when the Survey work was again being prosecuted further east under Lt. Woodthorpe, R.E. Butler was a splendid officer for such a frontier, and the Survey owed much to his untiring aid and to the interest he took in its proper extension."

Diplommatina elongata, Godwin-Austen. (Plate LXIV. fig. 6.)

*Diplommatina elongata*, G.-A. P. Z. S. 1892, p. 511.

*Diplommatina tumida*, var., G.-A. Journ. A. S. B. vol. xliv. pt. 2 (1875), p. 9, pl. iv. fig. 7.

*Original description*:—"Shell elongately fusiform, thin, pale yellowish green; sculpture very faint above, quite smooth on the last three whorls; spire attenuate, sides flat; suture moderate; whorls 8½ to 9, the antepenultimate the largest; constriction in front above the aperture; last whorl ascends slightly; aperture oval, vertical; peristome double, thickened, slightly reflected: columellar tooth small and remote. Alt. 0·22; diam. 0·13 inch.

"*Locality*. Kézákenomih, Naga Hills.

"This shell is a better type of this form of *Diplommatina* than the very tumid shell first described from Asalu; the form changes much in different localities, in some being much more solid and more distinctly and distantly sculptured near the apex; a variety from the Eastern Burrail is 0″·20 in alt., rich dark amber-coloured, has the three lower whorls smooth and glassy, the columellar tooth still more remote, and the constriction just behind the peristome; it departs so widely from the original type that it might almost be separated."

The typical shells of my *D. tumida* (J. A. S. B. xxxix. (1870), pt. 2, p. 6, pl. ii. fig. 2) (which is badly copied from my drawing) came from Nenglo, in the North Cachar Hills, not far from Asaloo (see Plate LXIV. fig. 5). As I collected eastward the form changed, so that in the longitude of Munipur it does not correspond with the original type, but it is not so distinctly different as *D. elongata*. On Nougmaiching Peak (5135 ft.), which is a conspicuous point seen from Imphal, the capital of Munipur, and lying to the east of the valley, a small form occurred, with the peristome less circular, the form less tumid, and quite smooth on the last whorls. On Laisen Peak, 5173 ft., in the mountains to the north of Munipur, I found another variety slightly differing from this.

Diplommatina tumida, var. (Plate LXIV. fig. 7.)

*Diplommatina tumida*, var., G.-A. P. Z. S. 1892, p. 512.

*Locality*. Nongmaiching Trigonometrical Station, Munipur (type figured).

*Original description*:—"Shell dextral, elongately fusiform, not rimate; sculpture, fine costulation on the 5 apical whorls, the last

smooth; colour pale greenish; spire with convex sides, apex acuminate; suture well impressed; whorls $7\frac{1}{2}$, penultimate and antepenultimate equal; constriction above the aperture but towards the right-hand side; aperture oval, vertical; peristome thickened, double; columellar margin straight and angulate below, the tooth in front, moderately large.

"Size: maj. diam. 2·4; alt. axis 5·0 mm."

DIPLOMMATINA AMBIGUA, Godwin-Austen. (Plate LXIV. fig. 2.)

*Diplommatina ambigua*, G.-A. P. Z. S. 1892, p. 513.

*Locality*. South of Burrail Range, Munipur (*Godwin-Austen*).

*Original description*:—"Shell dextral, large, solid; sculpture, fine, rather close costulation on all the whorls: colour horny white; spire high, sides rather flat above, apex rather acuminate; suture impressed; whorls 8, flatly convex; constriction in front, above the aperture; aperture oval, vertical; peristome strong, closely double, reflected; columellar tooth small for size of the shell, situated well in front and directed downwards.

"Size: maj. diam. 3·0; alt. axis 5·5 mm.

"This is one of the largest species from these mountains. I also got it at Kezakenomih; one specimen measuring 6·5 mm. in height of spire."

DIPLOMMATINA COMMUTATA, Godwin-Austen. (Plate LXIV. fig. 4.)

*Diplommatina commutata*, G.-A. P. Z. S. 1892, p. 513.

*Locality*. Prowi, Lahupa Naga Hills (*Godwin-Austen*).

*Original description*:—"Shell dextral, elongately fusiform; sculpture, 4 apical whorls finely costulated, the last whorls nearly smooth; colour pale sienna; spire with convex sides; suture moderately impressed; whorls $7\frac{1}{2}$, sides convex, antepenultimate rather the largest; constriction in front, above the aperture, but to the right side; aperture oval, vertical; peristome double; columellar tooth sharp, well developed, directed downwards and well in front.

"Size: maj. diam. 1·75; alt. axis 3·0 mm.

"A large form of this I found at Tellizo Peak, Anghami Naga Hills, on the North Munipur frontier-line."

DIPLOMMATINA GAROENSIS, Godwin-Austen. (Plate LXIV. figs. 3, 3 *a*.)

*Diplommatina garoense*, G.-A. P. Z. S. 1892, p. 511.

*Locality*. Garo Hills; exact locality unknown (*W. Robert*).

*Original description*:—"Shell dextral, globosely fusiform, solid; sculpture, distant, very fine ribbing on the 3 apical whorls, the rest smooth and shiny; colour pale ochraceous; spire high, side very convex; apex acuminate, and when viewed from the side the axis is curved; suture impressed; whorls $6\frac{1}{2}$, all tumid, the antepenultimate much swollen and by far the largest; constriction above the aperture; aperture vertical, oval; peristome very much thickened and double; columellar tooth moderately large.

"Size: maj. diam. 2·3; alt. axis 3·5 mm.

"This species may be known by its very large antepenultimate whorl and the curved axis of the spire, and its strongly developed peristome and smooth lower whorls. It formed part of a collection of shells made by Mr. W. Robert, of the Khasi Hill Survey party, in the Garo Hills, during the military expedition into them in 1872–73. Ten specimens were found."

*Constriction on side, behind the peristome; sculptured throughout.*

DIPLOMMATINA DOHERTYI, Godwin-Austen. (Plate LXV. figs. 1, 1*a*.)

*Diplommatina dohertyi*, G.-A. P. Z. S. 1892, p. 513.

*Locality*. Margarita, Upper Assam (*W. Doherty*, in coll. T. H. Aldrich).

*Original description*:—"Shell dextral, very tumidly fusiform, strong, not rimate; sculpture, fine rather distant costulation on all the whorls; colour very pale, with a pinkish tint or ochraceous; spire, sides flat, rapidly diminishing, apex acuminate; suture impressed; whorls 8, last 3 whorls with convex sides, the penultimate the largest; constriction on side, well behind the aperture; the last whorl rises near peristome; aperture nearly circular, subvertical, rounded below; peristome double, outer somewhat reflected, and sinuous on margin; columellar tooth small, blunt, situated within the aperture, in many specimens it is not seen when viewed directly in front.

"Size: maj. diam. 3·0; alt. axis 6·4 mm.

"This shell is from the Eastern Naga country; there were two lots in Mr. Doherty's collection—one with a few specimens labelled 'Margarita,' another, a numerous lot, marked only 'Naga.'"

DIPLOMMATINA THOMSONI, Godwin-Austen. (Plate LXV. figs. 2, 2 *a*.)

*Diplommatina thomsoni*, G.-A. P. Z. S. 1892, p. 514.

*Locality*. South Burrail (*Godwin-Austen*).

*Original description*:—"Shell dextral, elongately fusiform; sculpture, 3 apical whorls smooth, all the rest with very fine regular, rather close ribbing; colour whitish; spire rather high, sides flattened; apex rather blunt; suture moderately impressed; whorls $7\frac{1}{2}$, sides convex, the antepenultimate the largest, last whorl ascending near the aperture; constriction lies directly behind and adjacent to the peristome; aperture oval; columellar tooth small for size of shell and lying within the aperture; peristome as usual.

"Size: maj. diam. 2·4; alt. axis 5·0 mm.

"I have named this species after Col. Mowbray Thomson, who, at the time it was collected, accompanied our camp in his capacity of Political Agent of Munipur, while the boundary of that State was being surveyed by me in 1872–73; in carrying out this work he rendered us great assistance, although much thwarted by the unfriendly action of the Munipur Durbar.

"In general form this shell is like *D. pachycheilus,* Bs., a Darjiling species, but the columellar tooth is never so large as in that species."

Diplommatina nengloensis, Godwin-Austen. (Plate LXV. figs. 3, 3 *a*.)

*Diplommatina nengloensis,* G.-A. P. Z. S. 1892, p. 514.

*Locality.* Nenglo, North Cachar Hills (*Godwin-Austen*).

*Original description*:—"Shell dextral, elongately fusiform, large, solid; sculpture very fine, moderately distant ribbing; colour pale ochraceous; spire high, with flat sides, apex acuminate; suture shallow; whorls $8\frac{1}{2}$, sides flatly convex; constriction some distance behind the aperture, on side; aperture widely ovate, expanded towards the outer margin; peristome double, not thickened; columellar margin subvertical, the tooth very small and remotely situated.

"Size: maj. diam. 2·9; alt. axis 4·0 mm.

"This is a very distinct shell; in its very ovate aperture and small columellar process or tooth it is unlike any other I have in my collection."

Diplommatina distincta, Godwin-Austen. (Plate LXV. figs. 4, 4 *a*, 4 *b*.)

*Diplommatina distincta,* G.-A. P. Z. S. 1892, p. 514.

*Locality.* North of Burrail Range, Naga Hills (*Godwin-Austen*).

*Original description*:—"Shell dextral, small, rather depressedly fusiform; sculpture very fine close ribbing; colour pale horny; spire conoid; apex blunt; suture impressed; whorls 7, sides convex, the antepenultimate the largest; constriction on the side, well behind the aperture; aperture vertical, irregularly ovate; peristome thin; columellar tooth very large for size and in front.

"Size: maj. diam. 2·0; alt. axis 3·4 mm.

"There is only one specimen of this species, but it is very different from any of the smaller forms in having the constriction behind the aperture, and, for so small a shell, in having the columellar tooth so large."

*Constriction on the side, behind the peristome; last whorls smooth.*

Diplommatina khunhoensis, Godwin-Austen. (Plate LXV. fig. 5.)

*Diplommatina khunhoensis,* G.-A. P. Z. S. 1892, p. 515.

*Locality.* Khunho Peak and Trigonometrical Station, 8809 ft. above the Mao villages, Naga Hills (*in coll. H. H. G.-A.*).

*Original description*:—"Shell dextral, ovately fusiform, not rimate: sculpture, fine regular costulation on the 3rd, 4th, and 5th whorls, the two apical smooth, the last whorls polished and glassy; colour pale sienna; spire, side flattened near the apex, which is somewhat acuminate; suture impressed; whorls 8, the antepenultimate the largest; constriction behind the aperture on the penultimate whorl;

aperture oval and vertical; peristome double, strong, continuous; columellar tooth well developed, rather remote.

"Size: maj. diam. 2·2; alt. axis 4·8 to 5·2 mm.

"Six specimens were found.

"A form rather longer and less swollen occurs in the same range; about 30 specimens were obtained at Gnameh Peak (5585 feet), near the Barak River.

"There is another form much smaller, being only 3·5 mm. in length, with the same glassy last whorls and the constriction rather further back, behind the aperture. Examples of this were also found at Sikhamih, in the Lahupa Naga Hills. I distinguish this variety as *khunhoensis*, var. *minor*."

DIPLOMMATINA LAPILLUS, Godwin-Austen. (Plate LXV. figs. 6, 6 *a*.)

*Diplommatina lapillus*, G.-A. P. Z. S. 1892, p. 515.

*Locality*. Kopamedza Peak, Lahupa Naga Hills, 8375 ft. (*Godwin-Austen*).

*Original description*:—"Shell dextral, elongately fusiform, tumid below, not rimate; sculpture fine, regular, close costulation, which is often much worn down; colour (bleached); spire with sides flattened, apex acuminate; suture shallow; whorls 8, sides flatly convex, the antepenultimate the largest; constriction of the penultimate whorl on the side, well behind the aperture; aperture oval, subvertical; peristome thickened, double, rounded below; columellar tooth small and far back within the aperture.

"Size: maj. diam. 3·0; alt. axis 6·0 mm.

"Three specimens, marked from the 'north of the Burrail Range.' Two are from the typical locality given above."

DIPLOMMATINA COMPACTA, Godwin-Austen. (Plate LXV. figs. 7, 7 *a*, 7 *b*.)

*Diplommatina compacta*, G.-A. P. Z. S. 1892, p. 515.

*Locality*. South of Barak in Munipur (*Godwin-Austen*).

*Original description*:—"Shell dextral, small, tumidly fusiform; sculpture, the two apical whorls smooth, two next with fine close ribbing, the last three whorls smooth or glassy; colour pale ochraceous white; spire, sides rather flat, apex moderately blunt; suture slightly impressed; whorls 7½, the antepenultimate the largest and tumid; constriction on the side, well behind the aperture, at about 1 millim. distant; aperture oval, vertical; peristome double; columellar tooth large in front, and directed downwards.

"Size: maj. diam. 1·8; alt. axis 3·5 mm.

"A larger shell (fig. 7 *b*), with rather a different shaped spire 4 mm. in height, was found at Asalu, with the constriction in same position.

"It is an allied form of *D. jatingana*, from the North Cachar Hills, which is a larger, more tumid species, with the constriction farther behind the aperture (Pl. LXV. figs. 8, 8 *a*).

"A single specimen, only 3 mm. in height, was sorted out of the box containing *D. chennelli*, from the Lhota Naga Hills."

Diplommatina japvoensis, Godwin-Austen. (Plate LXVI. figs. 11, 11 *a*.)

*Diplommatina japvoensis*, G.-A. P. Z. S. 1892, p. 516.

*Locality*. Japvo Peak, Anghami Naga Hills, 10,000 ft. (*Godwin-Austen*).

*Original description*:—"Shell dextral, fusiform, thin texture; sculpture, close rather fine ribbing; colour pale ochraceous; spire conic, apex blunt; suture moderately impressed; whorls 7½, sides convex, swollen below; constriction in front, towards the outer margin of the peristome; aperture oval, vertical: columellar tooth fairly developed, blunt; peristome closely double, of weak structure.

"Size: maj. diam. 2·4; alt. axis 3·8 mm.

"This is larger than the other species from this peak and elevation; and is the species described as *D. sherfaiensis*, var., J. A. S. B. 1875, p. 9, pl. iv. fig. 5; but as it is sufficiently distinct from the form found on Sherfaisip Peak, far to the west, and also from another found on Shiroifurar Peak, I think it better to give a distinctive title."

*Small species, with columellar process.*

Diplommatina unicrenata, Godwin-Austen. (Plate LXVI. fig. 1.)

*Diplommatina unicrenata*, G.-A. P. Z. S. 1892, p. 516.

*Locality*. Eastern Naga Hills (*W. Doherty*, in coll. T. H. Aldrich).

*Original description*:—"Shell dextral, ovately fusiform, subrimate, rather thin; sculpture, distant strong costulation on all the whorls; colour white, with a pale lemon-yellow tint in fresh shells; spire with sides convex, apex somewhat blunt; suture well impressed; whorls 7½, antepenultimate the largest, sides convex, the constriction above the aperture, in front; aperture circular, vertical; peristome double, outer wavy in outline, with one very marked and decided crenulation on the upper outer margin, and a slight sinuation on the left lower margin; columellar tooth large and directed downwards.

"Size: alt. axis 4·0 mm.

"A very large number of this new shell are in Mr. Doherty's collection, four from Margarita in a tube, the remainder marked as from the Naga Hills. This is a very beautiful new species, the only shell approaching it that I know from this region being *D. angulata* of Moulmain."

Diplommatina animula, Godwin-Austen. (Plate LXVI. fig. 2.)

*Diplommatina animula*, G.-A. P. Z. S. 1892, p. 516.

*Locality*. Prowi, Lahupa Naga Hills, Munipur (*Godwin-Austen*).

*Original description*:—"Shell dextral, ovately fusiform, thin and

delicate, and glassy texture; sculpture, rather distant well-marked costulation; colour whitish grey; spire moderately high, sides convex, apex blunt; suture impressed; whorls 6, tumid, sides very convex, antepenultimate the largest; constriction in centre, above the aperture; aperture widely ovate, vertical, angulate on the lower margin of the columella; the tooth large and well developed; peristome very strong.

"Size: maj. diam. 1·3; alt. axis 2·0 mm.

"This is another minute shell, differing from all others I have seen in the strong peristome and large columellar tooth. *D. delicata* is its nearest ally."

Diplommatina subrubella, Godwin-Austen. (Plate LXVI. figs. 3, 3 *a*.)

*Diplommatina subrubella*, G.-A. P. Z. S. 1892, p. 517.

*Locality*. Japvo Peak (*Godwin-Austen*).

*Original description*:—"Shell dextral, small, fusiform; sculpture, fine, regular, rather close costulation; colour pale reddish; spire high, sides convex, apex blunt; suture impressed; whorls $6\frac{1}{2}$, sides convex, penultimate and antepenultimate equal; constriction in front, above the peristome; aperture circular, nearly vertical; columellar tooth very small and internal; peristome closely double, not thickened.

"Size: maj. diam. 1·4; alt. axis 2·6 mm.

"This is a close ally of *D. sherfaiensis*, but is much smaller and has a coarser sculpture."

Diplommatina subtilis, Godwin-Austen. (Plate LXVI. figs. 4, 4 *a*.)

*Diplommatina subtilis*, G.-A. P. Z. S. 1892, p. 517.

*Locality*. Margarita (*W. Doherty*, in coll. T. H. Aldrich).

*Original description*:—"Shell dextral, elongately ovate, thickened; sculpture, fine, close, regular costulation throughout; colour pale sienna-brown; spire with convex sides, apex blunt; suture impressed; whorls 6, sides convex, penultimate slightly the largest, the last does does not rise much upon the penultimate; constriction in front, but not well marked; aperture circular, suboblique; columellar tooth well developed for the size of the shell; peristome double, strong.

"Size: maj. diam. 1·0; alt. axis 1·5 mm.

"This is a good species, one of the smallest; its elongated form separates it at once from *D. parvula*, the finer costulation and larger size from *D. minuta*."

Diplommatina delicata, Godwin-Austen. (Plate LXVI. fig. 5.)

*Diplommatina delicata*, G.-A. P. Z. S. 1892, p. 517.

*Locality*. E. Naga Hills? (*W. Doherty*, in coll. T. H. Aldrich).

*Original description*:—"Shell dextral, very small, tumidly fusiform; sculpture very distant, strong costulation; colour pale horny;

spire rather depressed, sides convex, apex blunt; suture well impressed; whorls 6, sides convex, swollen, antepenultimate the largest; constriction above the aperture; aperture ovate, vertical; columellar tooth well marked; peristome as usual.

"Size: alt. axis 1·75 mm.

"There are only two specimens in the collection among those merely labelled Naga Hills, but I have every reason to think they were from near Margarita."

*Small species, with very minute or no columellar process or tooth.*

Some conchologists might consider these worthy of subgeneric distinction, and the *Diplommatininæ* have been already much split up. It is perhaps undesirable after all to increase the number of subgenera on small differences of shell-development, for it becomes at last so very difficult to locate the intermediate forms.

Diplommatina munipurensis, Godwin-Austen. (Plate LXVI. fig. 6.)

*Diplommatina munipurensis*, G.-A. P. Z. S. 1892, p. 518.

*Locality*. South of the Barak River, between the Mao villages and Munipur (*Godwin-Austen*).

*Original description*:—"Shell dextral, elongately fusiform; sculpture minute, close costulation; colour very pale greenish grey; spire symmetrical, sides slightly convex; suture well impressed; whorls $6\frac{1}{2}$, sides convex; constriction in front and immediately above the aperture; no columellar tooth, its position indicated by a slight sinuosity on the columellar margin; aperture nearly circular, subvertical; peristome closely double, very slight in form, the inner does not spread much upward on the penultimate whorl.

"Size: maj. diam. 1·5; alt. axis 2·7 mm.

"From the number of specimens found, this appears a very abundant species; I never got anything like it in the Khasi Hills to the west."

Diplommatina venustula, Godwin-Austen. (Plate LXVI. figs. 7, 7 *a*.)

*Diplommatina venustula*, G.-A. P. Z. S. 1892, p. 518.

*Locality*. Japvo Peak, Anghami Naga Hills (*Godwin-Austen*).

*Original description*:—"Shell dextral, elongately fusiform, thin; sculpture, fine, regular, close costulation throughout; colour pale amber; spire high, sides flattish, apex acuminate: suture impressed; whorls $7\frac{1}{2}$, sides convex, the penultimate the largest; constriction in front above the aperture; aperture widely ovate, suboblique; peristome but slightly developed, narrowly double, expanded into a small wing on the upper and outer margin, giving it a very sinuated margin; no columellar tooth.

"Size: maj. diam. 2·1; alt. axis 4·0 mm.

"This species, of which I only obtained three specimens, is quite distinct, as shown in the form of the spire and particularly the expanded side of the peristome, which is an unusual character."

DIPLOMMATINA DOMUNCULA, Godwin-Austen. (Plate LXVI. fig. 8.)

*Diplommatina domuncula*, G.-A. P. Z. S. 1892, p. 518.

*Locality*. Margarita, Naga Hills (*W. Doherty*, in coll. T. H. Aldrich).

*Original description*:—"Shell dextral, fusiform; sculpture, strong, regular, distant costulation on all the whorls, much closer near the constriction, first two whorls smooth; colour pale whitish with an ochraceous tint; spire with convex sides, apex blunt; suture well impressed; whorls 7½, sides convex, antepenultimate the largest, last whorl does not rise upon the penultimate; constriction above the aperture; aperture circular, subvertical, curvilinear as seen from the side; peristome double, not very much thickened; columellar tooth very minute, internal.

"Size: maj. diam. 1·3; alt. axis 3·0 mm.

"This is a very distinct form, quite new to me, and belonging to a group which is not represented, so far as I know, in the Khasi and Jaintia Hills."

DIPLOMMATINA SUCCINEA, Godwin-Austen. (Plate LXVI. fig. 9.)

*Diplommatina succinea*, G.-A. P. Z. S. 1892, p. 519.

*Locality*. Anghami Naga Hills (*Godwin-Austin*).

*Original description*:—"Shell dextral, tumidly fusiform, thin and delicate in texture; sculpture, regular, rather close costulation; colour very pale amber, with stronger coloration on the apex; spire somewhat depressed, suture impressed; whorls 6, tumid, with convex sides; constriction above the aperture; aperture oval, vertical; columellar tooth only indicated by a slight swelling; peristome double, strong.

"Size: maj. diam. 1·3; alt. axis 2·0 mm.

"This minute species may be compared with *D. parvula* from the N. Khasi Hills, from which it differs in being larger, and in having a greater number of whorls and a much more tumid shape."

DIPLOMMATINA CONCINNA, Godwin-Austen. (Plate LXVI. fig. 10.)

*Diplommatina concinna*, G.-A. P. Z. S. 1892, p. 519.

*Locality*. Naga Hills, probably south of Margarita (*Doherty*, in coll. T. H. Aldrich).

*Original description*:—"Shell dextral, solid, fusiform; sculpture, very strong, rather distant costulation; spire tapering rapidly, apex acuminate; suture impressed; whorls 7, sides convex, penultimate and antepenultimate about equal in size; constriction hardly apparent, just above the aperture; aperture circular, vertical; columellar tooth quite minute, only an indication of it; peristome double, strongly developed.

"Size: alt. axis 1·6 mm.

"This is very distinct from any of the minute species I have hitherto examined from this part of India; it is distinguished by its thick shell and strong costulation."

*Sinistral species.*

Diplommatina gibberosa, Godwin-Austen. (Plate LXVI. figs. 12, 12 *a*, 12 *b*, 12 *c*.)

*Diplommatina gibberosa*, G.-A. P. Z. S. 1892, p. 519.

*Locality.* South of the Barak River between Munipur and Imphal (*Godwin-Austen*).

*Original description*:—"Shell sinistral, ovately fusiform; sculpture, very distant fine costulation, 9 ribs on the antepenultimate whorl when viewed from the front; colour very pale greenish; spire low, sides rounded, apex blunt; suture very impressed; whorls $4\frac{1}{2}$, very swollen, sides very convex, penultimate much the largest; constriction on penultimate in centre above the aperture; aperture oval, subvertical: peristome double, strong; columellar tooth small, internal.

"Size: maj. diam. 1·5; alt. axis 2·2 mm.

"The nearest ally of this species is *D. jaintiaca*, G.-A., figured in the J. A. S. B. vol. xxxviii. pl. iii.; it differs, however, much in form, particularly in the expanded penultimate whorl and in its very distant sculpture. A very large number of it were collected in the above-named locality, and a single example at Prowi in the Lahupa Naga country.

"In the collection sent me by Mr. Aldrich in a box marked Naga Hills were about 40 specimens of this shell (fig. 12 *b*). The exact locality was not recorded, but I take it they were from some part of the Anghami Naga Hills."

*Additional Notes on*

Diplommatina nicobarica, Godwin-Austen.

*Vide* Land & Freshw. Moll. Ind. pt. v. p. 185 (1886).

This species is no. 13 of Mr. G. Nevill's Amended Hand-list (p. 284) = *roepstorffiana*, Nevill, MS., from Katchall (*de R.*).

This species in Mr. de Roepstorff's collection bears the name of *D. carneola*, Stol., = *battemalvensis*, Nevill. In Nevill's 'Amended Hand-list' I find the title *roepstorffiana* entered and the typical locality Katchall, with 3 specimens from Camorta and 20 from Battemalve, collected by Ferd. Stoliczka. It is somewhat similar to *D. carneola* from Moulmain, but it is more elongate and the costulation much closer and finer.

Diplommatina nicobarica, var. battemalvensis.

*Diplommatina nicobarica*, var. *battemalvensis*, G. A. Nevill, MS.; P. Z. S. 1895, p. 454; Nevill's Hand-list, p. 284, no. 1, *D. carneola*, var. (? distinct species), Batté Malve, coll. Dr. F. Stoliczka.

I have discovered among some shells put up by Mr. G. Nevill two specimens in a tube, labelled as above, from the island of Battemalve; they agree in all characters with the last species, but are much larger and more tumid, the antepenultimate whorl being much larger than in *D. nicobarica*.

Size: maj. diam. 1·3; alt. axis 3·0; body-whorl 0·9 mm.

## *PULMONATA OPERCULATA.*

(*Phaneropneumona* of Gray.)

Mantle free from the nape, leaving the pulmonary cavity open. Animal unisexual. Operculum distinct, spiral, or annulated. (*Gray.*)

### Family CYCLOPHORIDÆ.

Genus CYCLOPHORUS, Montfort *, Con. Syst. ii. p. 290 (1810).—Type *C. lituus*, Martyn, Siam = *C. volvulus*, Müller: Pulo Condor.

Reeve gives as habitat Pulo Condor, India, Hongkong, and China.

*Annularia*, Schumacher, Essai, p. 196 (1817).

α. "Margine annulari lævi, simplici."—Type *A. aurantiacus*, Schum.: Burmah. (Conch. Ind. pl. xxxiii. fig. 4: Moulmain.)

β. "Margine lamelloso."—Type *A. fimbriata*, Pfr.: West Indies = *Choanopoma*, type *C. pulchrum*, Wood: Jamaica.

*Cyclophora*, Swainson, Malac. pp. 185, 336 (part.) (1840).

*Annularia*, Gray, Syn. Brit. Mus. p. 91 (1840-42).

*Aperostoma*, Troschel in Z. f. M. p. 44 (part.) (1847).—Type *volvulus*, Lam., and *mexicanum*, Mke.

It has been further divided into many subgenera †:—

*Cyclohelix*, Mörch (no description) (1871).—Type *C. crocatus*, Born: Nicobars.

*Theobaldius*, G. Nevill (no description), Hand-list, p. 275 (1878).—Type *C. annulatus*, Troschel: Ceylon. (Conch. Ind. pl. cxliii. figs. 1–4.)

=Group III. Discoidal species with thin opercula. W. T. Blanford, A. M. N. H. vol. xiii. p. 453 (1864).—Type *phænotopicus*, Bs.: Darjiling. (Conch. Ind. pl. iv. fig. 3.)

*Scabrina*, W. T. Blf. Contrib. Indian Malacol., J. A. S. B. p. 322 (1863).

Original description:—"*Testa late umbilicata, depressa, subdiscoidea, epidermide fusca hispidula induta; anfractibus rotundatis. Apertura circularis, peristomate incrassato. Operculum crassum, corneum, anfractuum marginibus lamellatim elevatis.*" (W. T. B.)

=Group II. W. T. Blanford, A. M. N. H. xiii. p. 452 (1864).—Type *C. pinnulifer*, Benson: Assam. (Conch. Ind. pl. iv. fig. 2.)

* Referred to in Part V. p. 165, and Plate LI. figs. 1, 2–2*d*.

† So long ago as 1864 Mr. W. T. Blanford published, in the Ann. & Mag. Nat. Hist. xiii. p. 441, a valuable paper "On the Classification of the Cyclostomacea of Eastern Asia," which was a great advance towards the systematic grouping of the Order, on other characters than the shell and operculum; and he writes, under *Cyclophorus*: "Within the area to which these observations especially apply there exist several distinct series of forms of this well-known and important genus, some of them differing from the type at least as widely as *Leptopoma* does. These should be separated as subgenera."

Blanford, under his Group II. Subgenus *Scabrina*, writes as follows:—it "comprises certain discoidal shells, also Burmese, as a type of which *C. calyx*, Benson [Conch. Ind. pl. iv. fig. 4, p. 2, Moulmain and not Akou-tong, Pegu, *vide* Blanford, J. A. S. B. 1865, p. 97, who never found it there], may be selected. The operculum is thicker than in other *Cyclophori*, and has free and rough margins to its whorls, so as to be absolutely identical with that of *Pterocyclos pullatus* [Conch. Ind. pl. cxxxv. figs. 2, 3, 4] and its allies. In *C. calyx*, also, there is a slight expansion of the outer peristome at the suture corresponding to the wing in *Pterocyclos*. A similar slight expansion is seen in *C. phanotopicus*, Bens. [Conch. Ind. pl. iv. fig. 3, Darjiling], from the Himalayas, which, however, has a thin operculum. I consider, therefore, that in these forms and in the Burmese species of *Pterocyclos* we have that almost complete passage from one genus into the other, to which I have already referred, and clear evidence of their close natural affinity. There can be little doubt that *Pterocyclos* belongs to the same subfamily as *Cyclophorus*; and its associated genera, *Rhiostoma, Spiraculum*, &c., must fall into the same group."

*Craspedotropis*, W. T. Blanford, A. M. N. H. vol. xiii. p. 454 (1864).—Type *C. cuspidatus*, Benson: Nilgiri Hills. (Conch. Ind. pl. cxxxv. figs. 1–4.)

Original description:—"*Testa acuminato-conoidea, carinata, epidermide fusca crassa fimbriam carinæ prabente induta. Operculum arctissime spiratum.*" (W. T. B.)

*Micraulax*, Theobald, J. A. S. B. p. 185, pl. xiv. fig. 4 (1876).—Type *C. scaber*, Theob.: Travancore.

Original description:—"Cyclophori *habitu* Planorbulari, *testa sulco brevi intus instructa. operculo* — ?"

*Leptopomoides*, G. Nevill, Hand-list, p. 273 (1878). *Leptopomatoides* (nom. emend.), Zool. Rec. p. 78 (1878).—Type *halophilus*, Bs.: Ceylon. (Conch. Ind. pl. vi. fig. 3.)

=Group IV. W. T. Blanford, A. M. N. H. vol. xiii. p. 453, (1864).—Type *cœloconus*, Bs.: South India. (Conch. Ind. pl. iv. fig. 5.)

*Myxostoma*, Troschel, Zeit. f. Malak., "Ueber die Gattungen der Cyclostomiden," p. 44 (1847).—Type *C. brevis*, Martyn: Pulo Condor.

Original description:—"*Deckel mit vielen Windungen, dick, lamellös; Gehäus niedrig, mit offenem Nabel. Mundsaum doppelt, an die vorletzte Windung anlehnend, der innere ganz ohne Einschnitt, der äussere bildet an der vorletzten Windung einen dillenartigen Vorsprung. Nur eine Art.*"

*M. petiverianum* (*Cycl. petiverianum*, Gray)=*brevis*, Martyn: Pulo Condor off Cochin China.

*Ditropis*, W. T. Blanford, Contrib. Ind. Malacol., J. A. S. B. p. 126 (1869).—Type *planorbis*, W. T. Blf.: Travancore. (Conch. Ind. pl. xxxvi. figs. 5, 6.)

*Lagocheilus*, Theobald, MS., see W. T. Blf. A. M. N. H. xiii. (1864) p. 452, Group I.; J. A. S. B. 1872, p. 269.—Type *scissimargo*, Benson: Tenasserim. (Conch. Ind. pl. vi. fig. 7.)

Original description:—"*Testa anguste umbilicata, turbinato-conica, parva, spiraliter lirata, epidermide fusca (in exemplis junioribus sæpe hispidula) induta. Peristoma incrassatum, superne ad angulum rima transversa breviter incisum. Operculum planum, tenue, albidum.*"

*Leptopoma*, Pfeiffer, Zeit. f. Malak. p. 108 (1847).—Type *acuminatum*, Sow.: Luzon.

Original description:—"*Operc. membranaceum, arctispirum, planum. Testa globoso-turbinata vel conica, anguste umbilicata. Perist. simplex, reflexum, marginibus distantibus, interdum callo tenuissimo junctis.*" 1. *ecarinata* and 2. *carinata*.

Cyclophorus, Montfort.

Gray (Cat. Phanerop. B. M. p. 35, 1852) divides the genus into two main groups based on form of the shell alone, and the very typical Indian species, such as *himalayanus* (Conch. Ind. pl. xxxiv. fig. 4) near *C. aurora*, and *siamensis*, &c., head the list.

Blainv. in Dict. Sc. Nat. xii. p. 290.
Blainv. Malac. p. 435.
Desh. in Encycl. Méth. ii. p. 236.
Pfr. in Z. f. M. pp. 47–107 (1847).
Do. p. 138 (1851).
Pfr. Consp. p. 10.
Gray in P. Z. S. p. 182 (1847).
Gray, Cat. Cycl. p. 15.
Pfr. Pneum. Mon. p. 54 (1858).

"*Operculum corneum, tenue, arctispirum, extus magis minusve concavum. Testa globoso-turbinata, depressa vel discoidea; peristoma continuum, expandum vel rectum.*"

H. & A. Adams, Gen. Rec. Moll. p. 279, pl. lxxxv. figs. 5, 5 *a*, 5 *b* (1858).

*C. tigrinus*, Sow., with operculum is here figured as a typical species together with *C. involvulus*, Müller, fig. 5 *c*. (*Vide* Conch. Ind. pl. ii. fig. 3: Ceylon.)

V. Martens, Die Preuss. Exped. Ost-Asien, p. 130 (1867).

The genus is here divided into seven groups according to the form of the shell, useful for purposes of identification.

In 'Zoological Journal,' vol. v. p. 462, Mr. W. H. Benson describes the animal of *C. involvulus*, Gray, MS.* (thus identified by Sowerby in 1834, afterwards described by Benson in A. M. N. H. 2nd ser. vol. xiv. p. 412 as *C. pyrotrema*):—" I found this beautiful species alive on the rocks of Sicrigully and among loose brick rubbish and under felled timber in the fort of Rajmahal on the 16th

* Probably the first notice of the animal of an Indian species of *Cyclophorus*, and pointing out how it differs from that of *Cyclostoma*.

December, 1830. I also procured dead shells from the rocks of Patharghata. It appears to be very plentiful in all these situations. I never met with it to the westward, either in the plains or among the rocks or hills of the Vindhyan ranges which border those plains to the southward. I have seen a worn specimen in a collection of shells made twenty-two or twenty-three years ago in Ceylon [this must be some other species]. The young shell being destitute of the thickened and continuous peristome, as well as of the rich orange colour which adorns that part, might, if met with destitute of an inhabitant, be easily mistaken for a *Helix*. The peristome when first reflected is also free from the orange colour, which it does not acquire until thickened and fully grown.

"In its exterior anatomy the animal differs from that of *Cyclostoma elegans*, as described by the Rev. M. J. Berkeley, A.M., in the 'Zoological Journal' (vol. iv. 1828–29, p. 278), only in the following particulars:—The foot has an oblong-ovate disk somewhat pointed behind, instead of an oval one pointed before and behind. The summits of the tentacula are not inflated, and are translucent instead of being opaque. The edge of the mantle is even, not crenulated. Lastly, the operculum is horny, not testaceous, and consists of many volutions instead of three, differing in the manner of construction from that of *Cyc. elegans* as much as that of *Littorina* does from the operculum of *Trochus*. Like the cognate genus *Helicina*, the animal uses its tentacula alternately to examine its path by means of the sense of touch.

"The colour of the animal is livid with some dark olive shades. The tentacula are blackish-olive with the exception of the translucent summits."

### *Amended characters of the Genus.*

*Animal.* Edge of the mantle free all round; sole of foot undivided; eyes at lower base of annulated tentacula. The male organ close below the right eye.

Teeth of radula $\frac{1}{2} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{2}$. The centre the largest, tricuspid; the side teeth narrow and elongate, tricuspid or bicuspid.

Operculum orbicular, horny, thin, more or less concave externally, with numerous narrow whorls and a large or small central nucleus.

Shell globosely turbinated, depressed or discoidal, usually widely umbilicated; aperture circular; peristome continuous, straight or expanded.

The description of the animal from life, taken from one of *Cyclophorus zebrinus* (Conch. Ind. pl. ii. fig. 2), of the Khasi Hills, is as follows:—"With long slender-pointed tentacles; eyes at base, as usual in this family. The mode of progression is very unlike that of the Helicidæ, with their eye-tentacles. It was curious to watch the careful manner and the frequency with which the tentacle used as a feeler was brought in contact with every projection in advance

and on the side. It gave one the impression that the power of sight in these creatures is very limited, and is perhaps less than that of the air-breathers having the eye at the extremity of the tentacle. Foot is somewhat pointed, mouth large."

Having received from Mr. W. T. Blanford a spirit-specimen of *Cyclophorus wahlbergi*, Benson, from Natal, which had been given him by Mr. J. Ponsonby, I have been led to make a comparison of the animals of some other species of *Cyclophorus* and *Cyclostoma* in my collection. A very cursory examination of this African species served to show a very remarkable divergence of structure in the position of the male organ, as compared with those species I was familiar with, from the North-east frontier of India, such as *Cyclophorus aurora*, Bs., the male and female of which I figured on Plate LI. Part V., and merely referred to on p. 165; also a divergence in this respect from a description of *Spiraculum hispidum* and drawings I made at the time from life. In both these species (*C. aurora* and *S. hispidum*) the male organ is on the right side of the head, below the right tentacle (*vide* Plate LI. fig. 1). I fortunately had spirit-specimens of *C.* (*Cyclohelix*) *crocatus*, from the Nicobar Islands, sent me by my brother, Mr. Harold Godwin-Austen; this, although having a shell so very unlike any species known on the Indian mainland, proved to be quite similar as regarded this part of the reproductive organs in the male; and I am therefore led to think, from analogy, that *C. foliaceus* from the Nicobars will be found to be structurally the same, although the shell shows even a greater departure from typical *Cyclophorus*. In *C. wahlbergi* the male organ is in a very different position, much nearer to the *anus* and on the centre line of the neck, quite far back under the edge of the mantle. The second considerable point of difference is found in the form of the operculum, when compared with *crocatus*; it is quite smooth internally, and very evenly, regularly, and broadly concentric, the scar left on its removal being a smooth plane surface. Now in *crocatus* the operculum is very flat, and has a strongly developed boss on the inside, which fits into a well-marked pit in the scar, and it is very indistinctly concentric in front. In *C. pearsoni*, Bs. (Conch. Ind. pl. xlviii. fig. 5), and *khasiensis*, Nevill, Hand-list, p. 273. no. 48, =*siamensis* (Conch. Ind. pl. xlviii. [not good] fig. 7) (being a misnomer, for it is not found in Siam), a similar but much smaller papillate central nucleus is seen, in front narrowly and closely concentric. In *C. aurora*, however, the internal side is very slightly convex, and the central nucleus is reduced to a minute size; in *C. borneensis* I find a small central boss. In the shell of *C. wahlbergi* we are presented with a third point of divergence, in the acutely edged peristome of the African mollusk.

So great a difference in the structure of the animal, involving a considerable modification of adjacent parts, combined with the two other marked characters of shell and operculum, are, I consider, of sufficient importance to constitute *wahlbergi* the type of a new

subgenus, for they indicate only a distant relationship to the other forms of *Cyclophorus* of which the animal is known. I propose the name *Natalia*, after the district Mr. Benson's type and Mr. Ponsonby's shell came from.

NATALIA, nov. subgen. (Plate LXVIII. figs. 1–4 *a*.)

Animal (from a single male specimen) with very short, undivided foot (figs. 1 & 1 *c*). The male organ (figs. 1 *a* & 1 *b*) situated on the centre line of the neck, rather nearer to the anus than the eye-tentacles; operculum (figs. 2 & 2 *a*) large and expanded, externally presenting a broad spiral, slightly concave in front, with a thin edge, and quite smooth internally. Radula like that of *Cyclophorus*. Shell with a sharp thin peristome.

It will be of interest to see over what area of Africa this subgeneric form will extend, and how far the animals of the *Cyclophorus* group of Madagascar approach it in their structure.

CYCLOPHORUS (NATALIA) WAHLBERGI, Benson.

*Cyclostoma wahlbergi*, Benson, Ann. & M. N. H. vol. x. p. 271 (1852); Pfr. Icon. n. 418, t. 50. figs. 17–19.

*Cyclophorus wahlbergi*, Gray, Cat. Phaneropneumona in B. M. p. 56 (1852); Pfr. Pneum. Mon. p. 416 (1858).

"This species is very similar to *Cyclotus translucidus* (Colombia) and *C. lutescens* (Brazil)."

Reeve, Conch. Icon. pl. xvii. fig. 81 (not very good).

*Cyclophorus* (?) *convexiusculus*, Pfr., Cape of Good Hope, P. Z. S. 1855, p. 104, "Operc. corneum, indistincte arctispirum." Var. *minor*, Bs., A. M. N. H. xviii. p. 438 (1856).

*Cyclophorus* (*Theobaldius*) *wahlbergi*, Nevill, Hand-list, p. 277 (1878). "I doubt if this form will prove to be a *Cyclophorus* at all."

In his 'Amended Hand-list' Nevill removes it from the subgenus *Theobaldius* and places it with the African species—*C. angolensis*, Dohrn (Jahrb. v. 1878, diam. 21, alt. 16 mm), *C. leonensis*, Morelet, and *C. lilliputianus*, Morl., 1873,—just before the Andaman and Nicobar species.

Original description :—"*Testa mediocriter umbilicata, depresso-turbinata, scabre et acute radiato-striata, luteo-glauca, epidermide fusca; spira vix elevata, acutiuscula; anfractibus 4, convexis, ultimo rotundato; apertura ampla, alta, rotundata, peristomate acuto; umbilico aperto, profundo.*

"Diam. major 14, minor 11, axis 7 mill.

"This is probably the species which Wahlberg got at Natal, and which by some misconception was attributed to the fauna of South Africa by Krauss, as *C. translucidum*, a South American shell possessed of a calcareous operculum, whereas that of the present

species is thin and horny. The example described was collected at Natal, with *Bulimus kraussi*, and transmitted to Mr. S. Stevens with other specimens of a smaller size."

Pfeiffer thus describes the operculum: "tenuissimum, arctispirum, corneo-lutescens, extus concaviusculum"; and the dimensions: major diam. 15, min. 12, alt. 8.

The animal (Plate LXVIII. figs. 1, 1 *a*), as preserved in spirit, has a blunt square head, the eye-tentacles being short and broad. The foot is also short (fig. 1 *c*), apparently not extending, even in life, much beyond the circumference of the operculum, whereas in *C. aurora* it is longer, and in *C. crocatus* (fig. 5 *b*) it is elongate. The operculum (figs. 2, 2 *a*) is spiral, of 5 whorls, broad and regularly increasing, with a thin edge, slightly concave in front, internally quite smooth, with no indication of a central nucleus. When removed from the animal the scar (fig. 2 *c*) is also quite smooth, with only a few concentric shallow furrows. The male organ is a solid muscular free sheath, the base (*b*.P.) on centre line of the neck about 5 mm. from the anal aperture and 7 mm. from the end of the snout, and was found bent over forwards to the right side. It is long, with a broad spatulate end, and the orifice appeared when on the slide and under slight pressure to be at the extreme point (fig. 1 *d*).

The buccal plates (fig. 3) are strong, similar to those of *Cyclophorus*, heart-shaped. Under high power (fig. 3 *b*) the central line is occupied with irregular quadrate-shaped small plates, which merge gradually on the side into the regular rows of platelets, as shown magnified in fig. 3 *a*; the comparative size of these little plates varies much in the different species. The teeth of the radula (figs. 4, 4 *a*) are quite of the character of typical *Cyclophorus*, the central being broad tricuspid, the first and second hooked and also tricuspid, the third hooked and bicuspid.

Having no further material from Africa, and nothing from Madagascar or the Mascarene Islands, the Nicobars from their position seemed to promise something interesting for purposes of comparison. I next describe one of the largest, and which is also the type of a subgenus of the Cyclophoridæ.

Subgenus Cyclohelix, Mörch (1871). (Plate LXVIII. figs. 5–8.)

Copenhagen, March 1871.

Type *C. crocatus*, Born, Mörch, Journ. de Conch. p. 316, Oct. 1872, with no description.

Nevill, Hand-list, p. 275 (1878).

H. & A. Adams, Genera Mollusca, p. 279, as a synonym of *Cyclophorus*.

The subgenus *Cyclohelix* was never described by Mörch, but only indicated. Its principal characters may be thus summarized:—

Animal with a long foot extending far beyond the operculum. Operculum indistinctly spiral, smooth in front, flat, thin; at back with a very large raised boss, fitting into a circular pit in the foot. Male generative organ as in *Cyclophorus aurora*, *pearsoni*, &c., as also the teeth of the radula.

Shell very solid and turbinate.

Its closest relationship is therefore with the Indian and Malayan forms.

CYCLOPHORUS (CYCLOHELIX) CROCATUS, Born. (Plate LXVIII. figs. 5–8.)

*Turbo crocatus*, Born, Index, p. 345 (1778).

*Trochus crocatus*, Born, Test. p. 338, t. xii. figs. 11, 12 (1780).

Var. *turbo*:

*Helix turbo*, Chemnitz, Conch.-Cab. ix. fig. 1059.

*Cyclostoma maculosa*, Jag. Cat. 1839, p. 121, t. vii. figs. 9, 10.

*Cyclostoma turbo*, Sowerby, Thes. p. 116. no. 75, figs. 102, 103, from Nicobar (collection Spengler). Mörch says specimens often differ slightly. In Journ. Conch. 1876, p. 360, Mörch says Spengler's examples measure 24 mm. in diameter.

*Cyclostoma* (*Cyclohelix*) *crocatus*, Born; Mörch, Journ. de Conch. p. 316 (1872).

*Cyclohelix crocatus*. Nevill, Hand-list, p. 274 (1878): Camorta.

*Cyclophorus turbo*, Reeve, Conch. Icon. pl. xiii. fig. 57.

The animal (figs. 5, 5 *a*) (from spirit-specimen) is like that of the Indian species *C. aurora*, *pearsoni*, &c.—the male organ (P.) being situated close below the right eye and right tentacula (*t.*), rather short and pointed. The foot is much longer (fig. 5 *b*). On the operculum being removed a deep circular pit is seen near the left central margin of the oval scar and into which the well-developed boss on the inside of the operculum fits.

The radula (fig. 7) is folded back on itself at the posterior end, where a retractor muscle (*r.m.*) is given off. It is enveloped by two equal-sized salivary glands. The buccal mass is bilobed and globular in shape. The buccal plates are about 3 mm. long on the central line, 6 mm. wide, and with fine tessellated surfaces.

The central tooth (fig. 8) is broad, with 5 cusps on the cutting-edge; it then narrows rapidly into a waist-like form, and expands again below to the bottom line of the lower plate. The first side-tooth is long and narrow, tricuspid, and the two next are smaller and indistinctly tricuspid.

The claim of this species for subgeneric rank is therefore not confined to the shell, but is borne out by other details of the animal.

The turbinate shell, *C. herklotsi*, v. Mart., from Japan (Die Preuss. Exped. Ost-Asien, p. 13), is represented as having a well-developed boss on the inside of the operculum (see pl. iii. fig. 1), but it does not stand out so conspicuously as in *C. crocatus*.

## *CYCLOSTOMACEA.*

Gray writes in the 'Catalogue of the Phaneropneumona,' p. 2:—"In *Cyclostoma*, which have a shelly operculum and simple mouth to the shell, the foot of the animal is divided into two equal parts by a longitudinal groove, and the animal walks by alternately moving forward first one and then the other of these sides. In *Cyclophorus*, *Pterocyclos*, and *Megalomastoma*, which have a horny many-whorled operculum, the foot is simple and the animal glides along like other Gasteropodes. Some of these, as *Pterocyclos*, have a more or less developed groove or hole at the hinder angle of the mouth. In others, as *Megalomastoma*, there is a prominent appendage to the mantle, which produces a groove and ridge in front of the mouth near the pillar, and in *Pupina*, which has been confounded with *Buccina*, the groove ends in a narrow-edged marginal notch."

This permanent appendage to the mantle referred to I have not yet seen, nor do I know whether Gray or some other naturalist has described it in proper detail.

### Family CYCLOSTOMIDÆ.

*Cyclophoridæ*, Gray, Nomencl. of Moll. Anim. & Shells Coll. Brit. Mus. 1850.

#### Genus Otopoma, Gray. (Plate LXVII.)

*Otopoma*, Gray, Cat. Cycl. p. 35. 1st type, *foliaceum*, Chemnitz; 2nd type, *Cyclostoma clausum*, Sow., Arabia. The majority of the other species placed in the genus have the umbilicus quite exposed.

*Otopoma*, Pfeiffer, in Z. f. M. p. 157 (1851); Consp. p. 29; Pneum. Mon. p. 179 (1852).

Divided into 2 sections (Cat. Phanerop. B. M. 1852):—

Group A. Umbilicus perfectly closed. Type *Cyclostoma clausum*: Arabia.

Group B. Umbilicus more or less open.

Section 1. Right margin of the peristome expanded. Includes:—

*C. auriculare*, Gray. —?
*C. albicans*, Sow. Hainan.
*C. naticoides*, Récluz. Socotra.
*C. guillaini*. *Ex* coll. Dohrn. Mogadoxa.
*C. unifasciatum*, Sow. Madagascar, Mauritius.

Section 2. Right margin of the peristome straight. Contains:—

*C. philippianum* (is a *Cyclophorus*). —?
*C. clathratulum*, Récluz. Yemen.
*C. vitellinum*, Pfr. Madagascar, Natal. Sec. *Rochebrunia*, Bourguignat.
*C. listeri*, Gray. Mauritius. = *fimbriatum*, Quoy (= type of *Ligatella*, Martens).
*C. hæmastoma*, Anton. Isle of France.
*C. politum*, Sowerby. —?
*C. spurcum*. Bombay. (Is a *Cyclotopsis*.)
*C. pygmæum*. New Ireland.

Section 3. Right margin of peristome slightly expanded, deeply sinuous.

*C. multilineatum*. Madagascar.

Subgenus Ligatella, Martens? = *Rochebrunia*, Bourg. Type *C. listeri*, Gray, Möbius, Meeresfauna Mauritius, &c., 1880.

Monsieur J. R. Bourguignat, in 'Mollusques Terrestres et Fluviatiles dans le Pays Çomalis Medjourtin,' 1881, divides *Otopoma* into three sections, founding two new subgenera. These, on purely conchological grounds, may be accepted as being useful for the identification of species, particularly of fossil forms, should they be discovered. I therefore introduce them here:—

1. Otopoma.

Section 1. Umbilicus not covered, and with a slight angulation on the columellar margin of the peristome. Type *O. balfouri*, G.-A.: Socotra. P. Z. S. 1881, p. 253, pl. xxvii. figs. 2, 2 *a*.

*O. foliaceum*, Chem., a Nicobar shell, and a *Cyclophorus* included by Bourguignat, must be removed, and there then remain with the above type:—
*O. complanatum*, G.-A. Socotra. P. Z. S. 1881, p. 254, pl. xxvii. figs. 3, 3 *a*.
*O. clathratulum*, Sowerby. Yemen.
*O. socotranum*, G.-A. . Socotra. P. Z. S. 1881, p. 254, pl. xxvii. fig. 4, as *O. clathratulum*, var. *socotrana*, G.-A.
*O. clathratulum*, var. *minor*, G.-A. Socotra. P. Z. S. 1881, p. 255, not figured.

Section 2. *Otopoma* subgenus *Georgia*, Bourguignat, *l. c.* p. 65. The umbilicus entirely covered with a thick callous reflexion of the peristome. Type *O. naticoides*, Récluz. Socotra.

*O.* (*Georgia*) *austeni*, Bourguignat. Socotra. = *naticoides*, Récluz. P. Z. S. 1881, p. 252, pl. xxvii. figs. 1, 1 *a*.
*O.* (*Georgia*) *guillaini*, Petit, Jour. Conch. i. 1850, pl. iv. fig. 3. Mogadoxa.
*O.* (*Georgia*) *clausum*, Sowerby. Yemen.

*O.* (*Georgia*) *yemenica*, Bourg. =*clausum*, var. B, L. Pfr. Pneumonop. xiv. p. 180 (1852); Cycl. in 2nd edit. Chemnitz, p. 330, pl. xlii. figs. 13–15 (1853).

*O.* (*Georgia*) *naticopsis*, Bourg. *l. c.* pl. iii. figs. 43–48. Somali.

*O.* (*Georgia*) *perrieri*, Bourg. *l. c.* pl. iii. figs. 50, 51. Somali.

*O.* (*Georgia*) *poirieri*, Bourg. *l. c.* pl. iii. figs. 54–56. Somali.

*O.* (*Georgia*) *revoili*, Bourg. *l. c.* pl. iii. figs. 52, 53. Somali.

The last four species all seem to be varieties of the same species, to which must be added

*O.* (*Georgia*) *hinduorum*, W. T. Blf. Kattiawar, India, on west coast.

Section 3. *Otopoma* subgenus *Rochebrunia*, Bourg. *l. c.* p. 77. Shell turbinately conical; peristome simple, circular. Type *O. obtusa*, Pfr. *l. c.* pl. iv. figs. 60–64. Zanzibar and south of C. Guardafui. Malak. Blätt. ix. 1862, p. 208; Novit. Conch. ii. p. 226. no. 329, pl. liv. figs. 3, 4 (1863); Mon. Pneumon. xiv. Supp. p. 123 (1865).

*Rochebrunia obtusa*, Bourg. Moll. rec. en Afr. Çomalis Medjourtin, p. 7, Feb. 1881.

He places in this subgenus:

*O.*? *philippiana*, Pfr. Locality unknown.

*Cyclostoma coquandiana*, Petit. Madagascar? Journal Conch. p. 417, pl. xii. fig. 2 (1852).

*O.*? *coquandiana*, Pfr. Malak. Blätt. p. 91 (1854); Mon. Pneum. xv. Supp. p. 111 (1858).

*Cyclostoma vitellina*, Pfr. P. Z. S. 1852, p. 64: et in 2nd edit. Chem. no. 353, pl. xliii. figs. 35, 36 (1853). Madagascar.

*Otopoma*?, Pfr. Consp. Cycl. no. 268, p. 61 (1852), & Mon. Pneum. ix. p. 184 (1882).

*Cyclostoma politum*, Sow. Thes. Conch. no. 18, p. 97, pl. xxiii. fig. 17 (1842); Pfr. Cycl. 2nd edit. Chem. no. 167, p. 155, pl. xxi. figs. 13, 14 (1853). Locality unknown.

*Cyclostoma guillainopsis*, Bourg.

*Cyclostoma guillaini* (*non* Petit), Pfr. Cycl. in 2nd edit. Chem. no. 234, pl. xxxiv. figs. 7, 8 (1853). Lives with *guillaini*, Petit*, near Mogadoxa.

*Cyclostoma* (*Otopoma*?) *grandidieri*, Crosse & Fischer, Jour. Conch. p. 185, pl. vii. fig. 3 (1868). Madagascar.

*Cyclostoma tricolor*, Pfr. Neue Cycl. in Zeit. f. Malak. p. 128, 1849. Alb-el-Goury.

*Cyclostoma gratum*, Petit, Jour. Conch. i. p. 53, pl. iii. fig. 10 (très grossie) (1850); Pfr. Cycl. in 2nd edit. Chem. no. 236, pl. xxxiv. figs. 11, 12 (1853). Island of Alb-el-Goury.

*Otopoma conicum*, G.-A. P. Z. S. 1881, p. 255, pl. xxvii. fig. 1, enlarged. Socotra.

*Otopoma turbinata*, G.-A. P. Z. S. 1881, p. 255, pl. xxvii. fig. 2. Socotra.

*R. revoili*, Bourg. pl. iv. figs. 65, 66. Found with *R. obtusum*, but is a much smaller shell. Somali.

* Jour. Conch. i. 1850, pl. iv. fig. 3.

Benson, in the A. M. N. H., Aug. 1859, p. 92, first described the animal :—"The examination of living specimens of *Otopoma clausum* Sow., from Kattiawar, enables me to contrast the animal of that shell with *Hybocystis.* In *O. clausum* the foot is moderate in length and composed of two long, narrow, parallel soles, separated by a deep sulcus, and having also a deep sinus between them at either end. The muzzle is greatly elongated, emarginate in front, and the lateral lobes are capable of considerable extension. The tentacula are moderate, hyaline, ringed, tumid and obtuse at the extremity. The eyes are prominent on the outer side of the tentacula near their base, not sessile on the head. On communicating to Mr. Theobald a remark on the peculiar sole of this animal, he stated that he had noticed it, and that its use was to enable the species to cling to the thin stems of the branches of the shrub which it frequented near the shore of Gopnath Point, on the Gulf of Cambay. The leaves which he forwarded were kindly examined for me by Sir W. J. Hooker, and were pronounced to be those of *Grewia betulifolia*, DeCand., an inhabitant also of Arabia, whence Sowerby's type specimens of *O. clausum* were procured."

These remarks really refer to a distinct species and noted as such by Mr. W. T. Blanford in A. M. N. H. xiii. p. 464 (1864), as *Otopoma hinduorum*, and described fully in J. A. S. B. 1870, pl. iii. fig. 6, p. 12.

The shell is figured also in the Conch. Indica, pl. vi. fig. 5, and a variety, with no locality given, fig. 6. Blanford remarks, J. A. S. B. 1870, p. 13: "From *Cyclostoma* (*Otopoma*) *clausum*, Sow., to which Mr. Benson referred the present form, it is distinguished by being smoother, and with a less excavated umbilical region and a higher spire.

"I have not previously published a complete description or figure of this shell. It is the most eastern form of the subgenus known, other forms assigned to *Otopoma* found in the Indian and Burmese areas having been shown to belong to the Cyclophoridæ."

It is interesting to note that the habits of this operculated form follow so closely those of the *Bulimi* of dry desert countries like Arabia and Socotra, &c. These latter are to be seen in closely packed masses on the stems of plants, the peristome firmly glued down to the surface of the plant-stalk.

The divided foot may possibly assist a small species like *Otopoma hinduorum* in its ascent of plants, but it cannot be said that this structure of the foot has any direct connection with a climbing habit or was brought about by such a habit. The character is one common to the Cyclostomidæ, and its physiological interpretation and original development have yet to be sought for, and must be of very remote evolutional origin.

Professor Bayley Balfour, the distinguished botanist, on his well-carried-out expedition to Socotra in 1880, brought back with him, among the very interesting collection of shells he then made, and which were recorded in the P. Z. S., Feb. 1st, 1881, some well-preserved spirit-specimens of *Otopoma.* I am thus enabled to give some details of the anatomy, and add them to the generic description of the genus.

Genus Otopoma (*amended character*).

Animal with a short oval divided foot. Margin of mantle free in front.

The muzzle divided into two lobes.

Eyes prominent on the outer side of the tentacula near the base.

The male organ is situated close to and just above the rectum at the right posterior side of the branchial chamber.

The teeth of the radula are narrow and elongate, with minute serration, arranged 3—1 . 3. No buccal plates.

Two species examined, *O. naticoides*, Récluz, and *clathratulum*, Récluz, var. *minor*, G.-A.

Otopoma naticoides, Récluz. (Plate LXVII. figs. 1–5 *a*.)

*Turbo foliaceus*, Chem. Conch.-Cab. ix. pt. ii. p. 59, t. 123. figs. 1069, 1070?

*Cyclostoma foliaceum*, Pfr. Chem. 2nd ed. n. 27, p. 36, t. 4. figs. 10, 11?

*Cyclostoma naticoides*, Récluz, Rev. Zool. Cuv. p. 3 (1843); Mag. Zool. pl. lxxiii. (1843); Pfr. *l. c.* n. 28, p. 37, t. 6. figs. 1–4.

*Cyclostoma naticoides*, Sow. Thes. n. 78, p. 117, t. 26. figs. 108, 109.

*Otopoma foliaceum*, Gray, Cat. Cycl. p. 35. n. 1 (part.).

*Otopoma naticoides*, Pfr. Consp. n. 263; Pfr. Pneum. Mon. p. 181 (1852).

*Cyclostoma naticoides*, Reeve, Conch. Icon. vol. xiii. pl. xviii. figs. 117 *a*, *b* (1862); Nev. Hand-list, p. 307 (1871).

*Otopoma naticoides*, Godw.-Aust. P. Z. S. 1881, p. 252, pl. xxvii. figs. 1, 1 *a* (=*austeni* of Bourguignat, doubtfully separable).

Original description:—"*Testa orbiculato-conica, subtus oblique convexa, albo-rosea; anfractibus quinis* $\frac{1}{2}$, *convexis, supremo obtuse planato, lævissimo, sequentibus tenuiter ac dense clathratis, infimo ventricoso, albido, longitudinaliter plus minusve plicato et striato, transversim rugis subacutis inordinatis cincto; apertura obliqua, intus luteo-fuscescente, peristomate albo, nitido, incrassato; umbilico callum latiusculum, compressum, album, valde incrassatun claudente.*

"Junior. *Testa spiræ anfractibus superioribus nigrescentibus, transversim regulariter sulcatis, longitudinaliter densissime striatis, subclathratis; peristomate minus incrassato, umbilicum versus angulato; umbilico profundo, pervio.*

"Long. 43, larg. du dernier tour 43 mm.; haut. de ce tour 22 mm.

"Opercule ovale, prolongé en angle obtus au côté supérieur, plan des deux côtés, testacé, blanc au dehors, formé de trois tours assez larges, sculptés de stries rayonnantes onduleuses: le centre lisse; face inférieure revêtue d'une pellicule jaune. Cet opercule est plus petit que l'ouverture. Je ne vois, entre le type et la coquille que je lui réunis comme jeune, aucun caractère de forme différente, si ce n'est plus de régularité dans les sillons des tours supérieures et son ombilic ouvert; ce qui tient à l'âge des deux coquilles. Leur opercule est exactement le même. . . . Habitant l'île de Socotra."

The animal is very pale ochre-coloured, with a short, broadly oval, divided foot (Pl. LXVII. figs. 1, 1 *a*); the muzzle is transversely striated. The penis (figs. 2, 2 *a*) is large, broadly thickened, and tongue-like, diminishing rapidly at the free end into a sharp point; the seminal duct appears to run down the side of the muscular sheath (fig. 2 *b*), and the seminal orifice (*P.ap.*) is situated on the flat underside, a very short distance from the pointed end. The rectum is situated immediately to the right, and runs as a tube attached to the side of the branchial chamber for some distance, and then has a short free end at the anal orifice (fig. 2 *a*, *An.or.*). In the female (fig. 3) the rectum is not so long, and the female orifice (*f.or.*) is just above it.

The centre tooth of the radula (fig. 4) is straight-sided, gradually narrowing from the base, elongate, bearing five minute cusps on a slightly curved edge. The first side-tooth (fig. 4 *a*) is very long, gradually widening from the base, and curving over and inwards at the cutting-edge, with about six or more small teeth. The second and third (fig. 4 *b*) are almost similar in form, narrowly elongate, sides parallel, with eight or ten minute serrations like the blunted teeth of a saw. On the underside of the buccal mass (fig. 5 *a*) a congeries of fine convoluted tubes was seen, representing the salivary glands.

OTOPOMA CLATHRATULUM, Récluz.

*Cyclostoma clathratulum*, Récluz, Rev. Zool. Cuv. p. 3 (1843), et Mag. Zool. pl. lxxiv. (1843). Socotra.

*Cyclostoma clathratulum*, Sowerby, is from Arabia.

*Original description*:—"Long. 22, larg. du dernier tour $23\frac{1}{2}$, hauteur de la spire $11\frac{1}{3}$ mm.

"Cette espèce me paraît jeune; ses rapports avec le jeune du *C. naticoides* me font croire qu'elle n'est qu'une variété de coloration de la même espèce; cependant les nombreux individus rapportés par M. le Commandant Jehenne sont tous colorés et sculptés de la même manière, et ont le péristome aigu et tranchant."

A spirit-specimen of *Otopoma clathratulum*, var. *minor*, G.-A. (Pl. LXVII. fig. 6), the shell of which was described by me in the P. Z. S. 1881, p. 255, was also examined. The male organ is in the same position, but has a more elongated form (fig. 6) and of the same diameter throughout. The radula is precisely like that of *O. naticoides*.

In the description of *Cyclostoma elegans* by the Rev. M. J. Berkeley, 'Zoological Journal,' vol. iv. 1828–29, the penis is described as "a flat, ligulate, transversely wrinked, pointed process, lying, when at rest, parallel to the rectum, and folded in the middle on itself." This agrees closely with that of *Otopoma*, and shows this to be in form and the position a common character of the Cyclostomidæ.

There were no spirit-specimens of any operculated land-shells from either South Africa or the Mauritius in the Natural History Museum with which I could compare this Socotran genus, and but one from Madagascar, viz. a *Tropidophora*. By the kindness of

Mr. Edgar Smith I have been enabled to examine this specimen, a very fine typical form named by Mr. E. Smith *Tropidophora betsileoensis*. It is a female specimen and was very difficult to extract without breaking the shell, which I refrained from doing as the animal was too hard to do much with. The radula proved most interesting, and it differs altogether from that of *Otopoma* (see Plate LXVII. figs. 4–4 *b*) even in the formula, which is (3′.3) 2.1.C.1.2(3.3′). Before receiving this, Mr. W. Moss very kindly forwarded me some well-mounted examples of radulæ, among them one labelled *Otopoma unifasciata*, Mauritius. Nevill, in 'Amended Hand-List,' records two specimens of this species in the Indian Museum, received from the collection of Dr. Dohrn, but stated to be from Madagascar. Whether the species is found in both these islands is therefore doubtful. The radula of this species

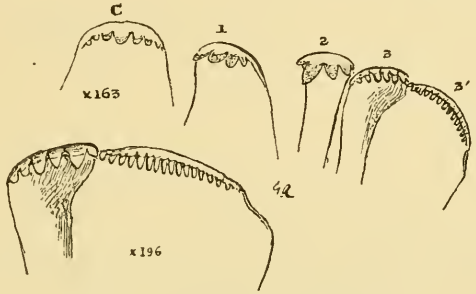


Fig. 1.—*Tropidophora ? unifasciata.*

(fig. 1) differs remarkably from that of true *Otopoma* (Plate LXVII. figs. 4–4 *b*), and is altogether a beautiful object. It indicates so considerable divergence from *Otopoma*, that when the animal comes to be examined and described it may give it a very distinctive position among the Cyclostomidæ.

The centre tooth is broad, sides sloping inwards from the base, with a large centre cusp, and three smaller on each side of it; the first side-tooth has similar sloping sides, rounded above, with four cusps; the second side-tooth has parallel sides and is five-cuspid; instead of the usual third side-tooth there are to all appearance four, the outermost being broad, like a rake in form, with very fine narrow sharp-pointed teethlets, set close together, about 14 in number; the next, or true third side-tooth, is narrower, with five cusps, much larger and more rounded in form, contrasting strongly with those on the outermost tooth; it is also apparent that this outer tooth can fold most upon itself, the inside margins being attached. The formula is therefore

$$\frac{\overbrace{3'.3}}{14-6}\cdot\frac{2}{5}\cdot\frac{1}{4}\cdot\frac{C}{7}\cdot\frac{1}{4}\cdot\frac{2}{5}\cdot\frac{\overbrace{3.3'}}{6-14}.$$

The radula of the *Tropidophora* (fig. 2, p. 32) in the British Museum, undoubtedly from Madagascar, was equally interesting, as it is of the type just described, not of *Otopoma*.

The centre tooth is rounded above, with straight sides sloping outwards to the broad base, tricuspid, but on some the large side cusp is replaced by two smaller ones; the second tooth is very rounded above into three large cusps: the second tooth has nearly parallel sides, sharply bent over on the cuspid edge, with four sharp narrow cusps; the third is made up of two very distinct portions,

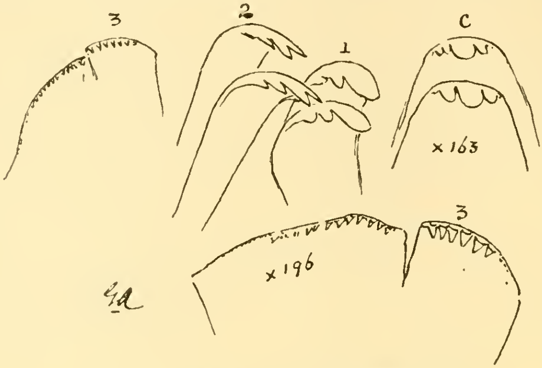


Fig. 2.—*Tropidophora betsileoensis.*

the inner one having 6–8 sharp-pointed teeth on a curved edge; then intervenes a long slit, and the next and outermost part is a curved edge, set with about twelve very fine saw-like cusps. In every respect it is like *unifasciata*, except that the outermost tooth is not so decidedly divided into two, the formula being

$$\frac{3'.3}{12-8}\cdot\frac{2}{4}\cdot\frac{1}{3}\cdot\frac{C}{3}\cdot\frac{1}{3}\cdot\frac{2}{4}\cdot\frac{3.3'}{8-12}.$$

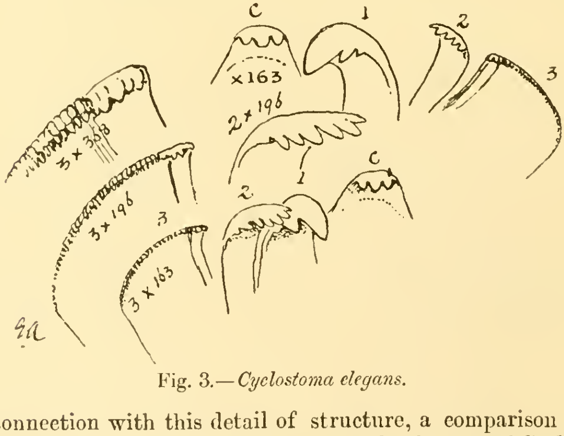


Fig. 3.—*Cyclostoma elegans.*

In connection with this detail of structure, a comparison of the radula of our English species, *C. elegans* (fig. 3), the type of *Cyclostoma*, is interesting as regards this almost complete and partial division of

the outermost tooth, and I figure it from a slide prepared by Mr. W. Moss *. It will be seen that, so far as the central and two outer teeth are concerned, little difference is to be found between the European representative and the African. But the outer tooth of *C. elegans* is very instructive. On the inner angle may be seen about four cusps, very different in form and size from the large regular series that follow, these last being very sharp and regular and minute as compared with them. Moreover, there is a distinct line of division, corresponding to these four or five larger cusps, all the way down the inside margin of the broad tooth ; this margin, like a selvage, being much thicker than the rest of the basal plate. I think we here have a distinct indication of the fusion of two original teeth into one, as is shown so well in the Mauritian *unifasciata*.

Dr. F. H. Troschel, in his excellent work 'Das Gebiss der Schnecken,' which contains such a mass of valuable detail, figures on plate iv. the radula of *Cyclostoma elegans* (fig. 8), and *costulatus* (fig. 9) of Europe; in his enlarged drawing of the species (fig. 10) he has shown the larger cusps on the interior side of the outermost tooth, but the band of marginal thickening is not indicated in the plate, but on p. 70, in his description, it is alluded to. Fig. 11 gives a row of teeth of *C. ligatus*, from the Cape of Good Hope: in this species it is interesting to find the outermost tooth corresponding with those I describe in the Madagascar and what is said to be a Mauritian shell. In *C. ligatus* the cuspid edge of the last tooth is divided into nearly three equal curved sections, that on the inner side having larger teethlets than the middle section. In fig. 12 Troschel gives a radula of *Leonia mammillaris*, also an African genus and species. In this species the outermost tooth shows also three distinct and differently cuspid divisions on curved edges. This structure presents to my mind a compound tooth of what was originally three distinct and separate side teeth in some far distant ancestor. Dr. Troschel describes these outermost teeth in all their details, but their signification he does not allude to.

The West-Indian species (*vide* Troschel, from figs. 13–26) of *Chondropoma* have a type of their own, very different from the European genus *Cyclostoma*, and depart in a greater degree from *Otopoma* on the one hand and *Tropidophora* on the other.

Dr. P. Fischer, in his 'Manuel de Conchyliogie,' has figured the radula of *Choanopoma* to illustrate this organ of the Cyclostomidæ; it would have been more correct had he selected the radula of *Cyclostoma elegans*, which is the type of the genus *Cyclostoma*, and with which all subgeneric comparisons must be made.

If the character of the radula has the generic weight which has been given to it by some authors, and I consider it trustworthy when combined, as it always should be, with other characters,

* Formula of *elegans* is

$$\frac{3'.3}{50-5}\cdot\frac{2}{7}\cdot\frac{1}{3}\cdot\frac{C}{3}\cdot\frac{1}{3}\cdot\frac{2}{7}\cdot\frac{3.3'}{5-50}.$$

*Tropidophora*, with *Leonia* &c., and *Otopoma* have long diverted from some earlier form. They both now occupy the two well-defined geographical areas of South Africa and Madagascar on one side, Eastern Africa north of the Equator, Arabia, to shores of the Western Indian Peninsula on the other. *Cyclostoma*, so distinct from them, occupies the European area and eastward into Asia as far as the Caspian and Persia.

It is exceedingly doubtful if true *Cyclostoma* extends to the West Indies, although I notice Nevill includes *banksianum* and *jayanum* in his 'Hand-list,' pp. 303 & 304. The teeth of both are given by Troschel on plate iv. figs. 15 & 17, showing they are of the character of the other West-Indian species of *Choanopoma*. If I am right in my conjecture that the outside tooth in *Tropidophora* is a compound one, then, allowing the mind to exercise a little imagination, we may take the radula of *Helicina* and compare it with *Tropidophora unifasciata*, and regard the large notched and solid tooth no. 4 of the first to be analogous with the inner large notched tooth no. 3 of the second: while the numerous outermost close-set teeth of *Helicina* correspond with no. 3′ of *Tropidophora*. The likeness can be strengthened if we imagine these outermost teeth in *Helicina* to be the upper margin of one wide elongate plate. The outermost teeth of *Chondropoma* show also, by the deep cleft edges, a growing together of what was once a series of separate teeth. It indicates, going back into the long eras of development, how far apart and how very different has been the line of descent of the Cyclostomidæ and the Cyclophoridæ, the latter lying in the direction of the Littorinidæ. We know nothing of the early stages of life of these genera of the Cyclostomidæ. Judging from the fact that the large *Bulimus* of Aden is viviparous, it is very probable that *Otopoma* of so dry and arid an island as Socotra is the same. Eggs laid would be desiccated, and the only chance of survival would be development in the body of the mother, or within the branchial chamber, until large enough, with a fall of rain, to crawl about and feed themselves. Very little is known, so far as I can ascertain, of the eggs and development of *Cyclostoma* or *Cyclophorus*; it is a branch of the history of these genera that requires investigation, as it may tell us much concerning their relationships.

### Subfamily Pupininæ.

#### Genus Pupina.

*Pupina*, M. Vignard, Ann. des Sci. Nat. vol. xviii. p. 439 (1829).—Type *P. keraudrenii*, Vignard, pl. xi. figs. 1 & 2 (a very good figure).

Original description:—"*Coquille turbinée, ovale, ouverture profondément fendue; columelle recourbée, tronquée.*" New Guinea.

*Moulinsia*, Grateloup, Ann. Soc. Linn. Bordeaux, xi. p. 429 (1840).—Type *M. nunezii*, Sow.: from the Philippines.

G. B. Sowerby, in a paper describing nine species of *Pupina* in 1841, describes the genus more fully:—

"*Testa subcylindrica, vitrea, nitidissima; anfractibus quinque ad sex, penultimo inflato, ultimo paululum coarctato; apertura circulari, margine crasso, reflexo, ad basin columellæ inciso, vel emarginato; operculum corneum, spirale.*"

He says the glossy enamel which gives a brilliant polish to the small terrestrial shells composing this genus seems to distinguish them even from those species of *Cyclostoma* which most nearly resemble them in having a pupiform shape and a notch at the base of the columella. The question has been asked, Why not make the marginal notch the criterion of the genus? The answer is found in the following facts:—first, the notch is found in *Cyclostomata* which have no other character in common with *Pupinæ*; second, that several *Cyclostomata* have a canal at the lower part of the whorl, which if continued would form a similar notch; third, that our *Pupina lubrica*, which could scarcely be separated from the genus, has but a very slight emargination.

*Pupina*, Sowerby, Thes. Conch. pt. i. p. 17, *ex parte* (1842). In the monograph of the genus by G. B. Sowerby, Jun., he divides it into three groups:—Sec. 1. The axis of the spire turned backwards: type *P. nunezii*, pl. iv. figs. 8, 9, 10, 11. Sec. 2. Spire nearly straight: *P. lubrica*, pl. iv. figs. 12–16. Sec. 3. Spire straight, with a notch at both ends of the aperture: *P. humilis*, Jacquemont, pl. iv. fig. 2.

*Pupina*. Gray (P. Z. S. 1847, p. 182) places this genus with *Realia* and *Callia* after *Megalostoma*, followed by *Registoma* and *Pomatias*.

*Pupina*, Menke & Pfeiffer, Zeit. f. Malakol. p. 110 (1847). In two divisions:—A. "Nitidissima' (*Moulinsia*, Grat.). Sec. 1. "Apertura integra": type *P. nunezii*, Grat. Sec. 2. "Apertura bicanaliculata": type *P. humilis*, Jacq.=*antiquata*, Sow. B. "Callo nitido destituta": type *P. sowerbyi*, Pfr.=*pupiniformis*, Sow., and *keraudrenii* is included.

*Pupina*, Menke & Pfr. Zeit. f. Malakol. p. 150 (1851). Sec. 1. "Callo nitido destituta": type *P. forbesi*, Pfr.=*P. grandis*, Forbes (see 'Voyage of Rattlesnake,' Appendix, p. 380, pl. 2. fig. 10, operculum with typical boss at back), with *P. humilis*, New Guinea, and *P. mindorensis*, Mindoro. Sec. 2. "Callo nitido undique obducta": type *bilinguis*, Eastern Australia, with *P. aurea*, New Ireland, and *P. bicanaliculata*, Philippines, and *P. keraudrenii*, New Guinea, the original type species.

*Pupina*, Pfr., Mon. Pneumonopomorum vivent. p. 139 (1852).

*Pupina*, Gray, Cat. of Phaneropneumona, or the Terrestrial Operculated Mollusca in the Collection of the British Museum (1852). Two divisions are made:—A. Shell not covered

with a glossy callous coat: *P. forbesi*, New Guinea (East), typical species. B. Shell shining, covered with a smooth callous coat: as typical species *P. bilinguis*, Pfr., from N.E. Australia.

Gray, Syn. Brit. Mus. p. 91 (1844).
Gray, Cat. Cycl. p. 33.
Pfr. Consp. p. 22.
Fischer, Man. Conchyl. p. 740 (1887).

Many subgenera have been constituted for species outside the Indian area. The single character of polished or unpolished surface had soon to be extended. G. Sowerby's divisions, based upon the angle of axis of spire, was the first advance; he made another in taking into consideration the notches on the peristome, a character of more value than he was at the time inclined to give it. This character is really of the first importance, and goes back to its initial origin in the ancestral stock. Blanford, writing in the A. M. N. Hist. July 1863, "On the Animals of *Raphaulus*, *Spiraculum*, and other Tube-bearing Cyclostomacea," indicates its probable rise to such a siphon-tube as exists in *Ampullaria*. The discovery by Mr. W. Doherty, in the island of Sangir, of a *Pupina* presenting well-defined elongate tubes at the right base and at the upper angle of the peristome, confirms this to a great extent. It is to be seen whether the basal tube in this species, when the animal comes to be examined, occupies the precise position and performs somewhat similar or modified functions as in *Ampullaria*. Whatever purpose it serves it tells us very plainly the origin of the peristomatal notches in this genus *Pupina*, and by analogy in some other genera and species of the Cyclophoridæ. In *Pupinella ceramica*, Martens (see Die Preuss. Exped. Ost-Asien, pl. 4. fig. 9), both on the sutural and columellar side, perfect tubes, although short, take the place of the usual slits. In *Pupinella mindorensis*, Adams & Reeve, this stage has not yet been attained, but a very slight increase of shell-deposit on the notch in the columellar margin would form a tube.

This genus of the Cyclophoridæ is one of the best defined, including in it some of the most gracefully formed and beautiful of land-shells by reason of the brilliant glossy surface of their shells. As regards the Indian species some little confusion has been brought about, caused in a measure by the figures in the 'Conchologia Indica,' evidently not taken from typical specimens, but from specimens supplied to the artist from some other source. This Mr. Nevill called attention to in his 'Hand-list,' p. 299. The figures 4, 5, & 6, *P. arula*, *artata*, and *blanfordi*, respectively, given on pl. vii., are all badly drawn. In fig. 4 the centre of the aperture is very nearly on a perpendicular let fall from the right-hand side of the spire: in fig. 5, supposed to be *artata*, there is the same error in a less degree, whereas in this shell the aperture is nearly central with the axis. Fig. 6, *blanfordi*, could not have been drawn from the supposed type, and is more like *P. peguensis* than anything else.

*Geographical distribution:—Pupina* is found along the Khasi Hill ranges, this being its extreme western extension; it has never

been obtained on the Eastern Himalayan range north of the Brahmaputra until long. 93° E. is reached in the Dafla Hills, where I found *P. imbricifera*, var. Including the subgenera, thence eastward and from the western shore of the Bay of Bengal and Malay Peninsula it extends to New Guinea and Australia.

## Species from Burmah, Tenasserim, and Nicobars.

PUPINA ARULA, Benson. (Plate LXIX. figs. 1, 1 *a*, × 4, from type specimen.)

*Pupina arula*, Bs. Ann. & Mag. Nat. Hist. vol. xvii. p. 230 (March 1856).

Conch. Ind. p. 4, pl. vii. fig. 4: Burmah (locality incorrect). Not at all like the type.

Theobald, Cat. Conch. Ind. p. 41.

Nevill, Hand-list, p. 300. no. 12, from Buket Pondong, Perak.

Blanford, J. A. S. B.

Do. A. & M. N. Hist. vol. xiii. p. 460 (1864).

Pfr. Mon. Pneum. vol. ii. p. 95.

Conch. Icon., Pupinidæ, pl. i. fig. 5 (not very good).

Original description:—" *Testa imperforata, conoideo-ovata, longitudinaliter striatula, nitidissima, fusco-rubella, apice conoideo, acuto, sutura calloso-marginata; anfractibus* 6, *ultimo spiram subæquante, antice breviter ascendente; apertura circulari, angulo superiori acuto adjecto, callo parietali superne lamella intrante munito; columella profunde incisa, canalem extus apparentem, lingua lata parietali obtectum, callisque duobus divergentibus marginatum, exhibente; peristomate obtuso, expansiusculo, extus marginato, margine dextro supra medium arcuato; basi foveata. Operculo* —?

" Long. 9, diam. 5 mill.

" *Hab.* ad Yunglaw, in valle Tenasserim, raro occurrens.

" It has much affinity with *P. aurea*, Hinds, the superior canal being rather simulated than actually developed, and being formed by an angle, at the top of the otherwise circular aperture, cut off from the lower portion, in part, by the parietal lamina."

Mr. Aldrich sent me two specimens of *P. arula* from the Caves in Perak; they agree with the type, and have the transverse ribbing mentioned by Benson.

The Benson collection at Cambridge now contains only two species of *Pupina*, viz., two examples of *imbricifera*, Bs. (wrongly labelled *umbricifera*), and one specimen of *arula*, Bs., locality wrongly given as India, whereas it came from Tenasserim. Benson's types of *artata* and *peguensis* appear, therefore, to have been lost. This *P. arula* I was very glad to see: there is much that is distinctive about it, and I have been able to figure it, thanks to Mr. Gwatkin, of the Museum at Cambridge. It is of the same size as that given in the original description (9 mm.), large and with distinct fine ribbing. Benson says " *longitudinaliter striatula* "; it is of a dark

sienna colour and polished. It cannot be confounded with *P. peguensis*, which is 6 mm., and Benson says (1860), at the end of his description of this last, that it differs from *arula* in its smaller size, form, proportions, translucence, and absence of sculpture.

In Mr. W. T. Blanford's collection there is a good series of *P. peguensis*, agreeing with Benson's description, but rather smaller in size, being 5·5 mm. as against 6 mm.; these are all from Henzada and Kama on the Irrawaddy.

The figure of *P. arula* in the Conch. Indica, pl. vii. fig. 4, is not like the type in form, and certainly not in coloration, being coloured grey, the size corresponding, viz. 9 mm. The figure of *artata* (fig. 5) must be something else. Fig. 6, same plate, is *P. blanfordi*, Theobald. The supposed type of this shell is now in the Natural History Museum, and came out of Theobald's collection; this I have figured. It is an old worn shell 5·5 mm. long, the colour gone; the aperture is also immature; the very ample body-whorl is not at all like any of the specimens I have examined from Pegu. I very much doubt its being the shell described from Pegu. Mr. Theobald's original description, in the J. A. S. B. 1864, p. 247, is so short that it is no assistance: "*politissima, flavescenti-cornea*" does not agree with the supposed type.

I have in my collection two specimens received many years ago from Mr. W. T. Blanford, and named by him *blanfordi* from Pegu, and a note on same label " near *P. artata*, Bs." They appear to me to be *P. peguensis*, and not at all like the Moulmain shell.

Pupina artata, Benson. (Plate LXIX. figs. 6, 6 *a*, 6 *b*.)

*Pupina artata*, Bs. Ann. & Mag. Nat. Hist. vol. xvii. p. 230 (March 1856); id. ibid. vol. iv. p. 94 (August 1859).

Sowerby, Thes. Conch. vol. iii. pl. 265. fig. 1.

Pfeiffer, Mon. Pneum. vol. ii. p. 96.

Conch. Ind. pl. vii. fig. 5.

Theobald, Cat. Conch. Ind. p. 41.

Nevill, Hand-list, p. 301.

Conch. Icon., Pupinidæ, pl. i. fig. 3, is not like the species, more like *peguensis*.

Blanford, A. M. N. H. vol. xiii. p. 460 (June 1864). He says "*P. artata* also occurs in Arakan and throughout the Irrawaddy valley as far north as Ava. It is a somewhat variable shell—one variety, from the neighbourhood of Prome and Thayet Myo, being somewhat more globose than the type, and having a rich orange peristome."

Original description:—"*Testa imperforata, pupiformi, ovato-acuminata, politissima, fusco-cornea, translucente, vel hyalina; spira ovato-conoidea, apice obtusiusculo, sutura callosa, lineari; anfractibus* $5\frac{1}{2}$, *convexiusculis, ultimo* $\frac{1}{3}$ *testæ partem superante; apertura verticali, circulari, bicanaliculata; peristomate obtusiusculo, margine parietali superne linguam acutam, callo verticali elongato, cum*

*margine dextro subparallelo, marginatum, exhibente, infra cum basali canalem incisum, ascendentem, extus calloso-marginatum, efformante. Operculo testaceo pauci-spirali, concaviusculo, sutura elevata.*

"Long. 6, diam. $3\frac{1}{2}$ mill.

"*Hab.* ad Moulmein satis frequens.

"It has some affinity with the Australian species of the genus."

Nevill, 'Hand-list,' p. 299, considers this the same as *P. blanfordi*, Theobald.

Failing to find the type, the shell I figure is one of four specimens from Moulmain, the typical locality; it differs from all those I have examined from Pegu in its greyer colour and greater flatness on the front or apertural side (compare fig. 6 *b* with figs. 3 *b*, 2 *a*, and 4 *a*). Further I have compared seven other Moulmain specimens, No. 28, in Mr. W. T. Blanford's collection; from all these it is also quite apparent that the channel in the columella is narrower and longer than in the species from the Irrawaddy valley, and I think it very doubtful if anything like the Moulmain form is found there.

Benson has described the animal of *Pupina artata* in the Ann. M. N. Hist., August 1859:—"Foot oblong, the sole being somewhat truncate in front and slightly angled at each side anteriorly, hinder extremity narrowed and pointed; muzzle declivous, entire; tentacula short, subulate, and swollen all round at the base; eyes black and prominent, situated on the hinder and external part of the basal swelling. The operculum is rather thick, horny, rounded at the thickened edge, and consists of $4\frac{1}{2}$–5 concave whorls divided by a raised edge. The inner surface has the umbonal region a little elevated. In my first description of the shell I stated that the operculum was calcareous, with few whorls. Dr. Pfeiffer, who had the specimen before him, made no alteration in the description, but observed that my characters were abnormal. The paucity of whorls was intended to be comparative with reference to the allied genus *Megalomastoma*. On taking out the operculum of that specimen its substance appears evidently to be horny; but neither in this species nor in the Khasia *P. imbricifera*, which has a still thicker horny operculum with a very prominent umbo internally, can it be said to answer Pfeiffer's generic description of 'membranaceous.' The animal was easily revived in two specimens with the operculum received from Capt. Haughton (Moulmein), and began at once to move about freely and fearlessly. No organ corresponding with the slits at the upper or lower part of the aperture can be detected."

According to Nevill, the species has been found as far south as Perak, where Dr. T. Townsend, of the 3rd Buffs, collected it at Buket Pondong. I have by me two specimens from the caves of Perak, kindly sent to me by Mr. Aldrich of Cincinnati. They do not agree with my Moulmain specimens, particularly in the form of the notch on the upper angle of the peristome. These I shall refer to in a future Part.

Pupina peguensis, Benson. (Plate LXIX. figs. 3, 3 *a*, 3 *b*, 3 *c*, 3 *d*.)

*Pupina peguensis*, Bs. A. M. N. H. vol. vi. p. 192 (1860).
Conch. Ind. p. 4, pl. vii. fig. 6, as *P. blanfordi*.
Theobald, Cat. Conch. Ind. p. 41.
Pfr. Mon. Pneum. vol. iii. p. 95.
Nevill's Hand-list, p. 300 (type): Shuay-Gheen, Burmah (coll. Captain Berdmore, 1878), and Zwagabin.

Specimen drawn is from Kama on the right bank of the Irrawaddy (coll. W. T. Blanford).

Original description :—"*Testa imperforata, subgloboso-ovata, lævigata, polita, pellucida, cornea; spira convexo-conica, apice acutiusculo, sutura calloso-marginata; anfractibus* $4\frac{1}{2}$, *ultimo spiram superante, antice breviter ascendente, ad basin foveato; apertura subverticali, sursum spectante, circulari, angulo acuto superne adjecto, callo parietali superne et lamella intrante munita; columella profunde incisa, canalem extus progredientem lingua lata superiore obtectum callisque duobus extus divergentibus marginatum exhibente; peristomate expansiusculo; margine dextro, supra medium arcuato, basalique crassiusculo obtusis.*

"Long. 6, diam. $3\frac{1}{2}$ mill.

"*Habitat* in regione Peguensi. Mus. Soc. Asiat. Calcuttensis.

"Closely related to the Tenasserim *Pupina arula*, B., but, independently of its smaller size, differing in form, proportions, translucence, and absence of sculpture."

Pupina limitaneus, n. sp. (Plate LXIX. figs. 4, 4 *a*, 4 *b*.)

*Locality*. Eastern frontier of Burmah and Siam (*Col. R. Woodthorpe*).

Shell ovately conoid, shining polished surface; sculpture none; colour pale ochre to dull whitish, black where parts of animal remain, probably black when living; spire conic, side convex, apex subobtuse; suture shallow, linear; whorls $5\frac{1}{2}$, the last twice as high as the spire; aperture circular, at suture a vertical slit, formed by the thickened upper margin and a short vertical lamella (fig. 4 *b*); columella with a deep narrow incision seen from front, the frontal flap narrow; peristome thick and obtuse.

Size: major diam. 3·0, alt. axis 5·0 mm.
Smallest ,, 3·0, ,, 4·5 mm.

This species is nearest to *P. peguensis*, but it is smaller, different in form, proportion of whorls, and the columellar slit is narrower. There were about a dozen specimens in the collection, obtained on the march to the Siam boundary delimitation in 1895 from base of the Shan Hills, east of Ava. In Mr. W. T. Blanford's collection, No. 39, there are four specimens, rather larger, but with a similar peristome and columellar groove, alt. 5·5 mm.

Pupina tongupensis, n. sp. (Plate LXIX. figs. 5, 5 *a*, × 8.)

*Locality.* Tongoop Pass, Arakan Hills, east side (*W. T. Blanford coll.* No. 38).

Shell globosely conoid, tumid, shiny; sculpture smooth, no striation; colour ochraceous; spire low, sides rounded, apex blunt; suture very shallow; whorls 5, very swollen; aperture circular, a deep cleft on upper angle, bounded by a short rounded lamella on the body-whorl; peristome not thickened, a narrow cleft on the columellar margin, external canal horizontal, narrow, upper margin moderately wide.

Size: major diam. 3·5, alt. axis 5·0 mm.

There are two specimens in Mr. Blanford's collection. The species differs in its small and globose form from all others I have examined, and the aperture is fully formed.

Pupina blanfordi, Theobald, from supposed type in B. M. (Plate LXIX. figs. 2, 2 *a*, 2 *b*.)

*Pupina blanfordi*, Theobald, in "Notes on some Indian and Burmese Helicidæ," J. A. S. B. 1864, p. 247.

Conch. Icon., Pupinidæ, pl. i. fig. 6, does not represent the supposed type in the B. M. in colour.

Original description:—"*Testa pupinæformis, politissima, flavescenti-cornea. Anfractibus quinque. Peristomate albo, non-expanso. Canalibus albis.*

"Long. 6, diam. 3·5 mill.

"*Habitat* Pegu.

"This species was forwarded to me by Mr. W. T. Blanford as a possible variety of *P. peguensis*, B. It is intermediate in its characters and aspect between *P. peguensis*, B., and *P. artata*, B., to the latter of which it more closely approaches in the shape and unreflected form of its peristome. Whilst, in fact, *P. blanfordi* ranks naturally as a near ally of *P. artata*, B., *P. peguensis*, B., holds a similar relation to *P. arula*, B., and it is questionable if all four species will not prove to be equally connected; *P. peguensis* coming between *P. artata* and *P. arula*."

This species must be suppressed, the immature worn shell in the B. M. cannot be accepted as the type originally described.

Pupina hungerfordi, Nevill. (Plate LXIX. figs. 7, 7 *a*.)

*Pupina hungerfordiana*, Nev. Hand-list, p. 300 (1878); G. Nevill, J. A. S. B. p. 148 (1881), pl. vi. fig. 6 (a good figure).

*Original description*:—"Shell about the same size as *P. imbricifera*, between which and *P. artata* it is fairly intermediate; from the former it can be distinguished by the slightly more produced spire and less convex whorls, much less everted last whorl, smaller aperture, even more evenly circular, and in a marked manner by the single instead of double peristome; the parietal callosity is quite

different, being compressed, vertical, and more lateral and produced; the incised canal at the columella is also more covered by the triangular callosity, above which it is less compressed and more evenly expanded; from *P. artata* by its size, proportions, and additional whorl, but especially by the quite different characters of the two callosities; the parietal callosity especially is quite different, being much longer (it reaches beyond the middle of the last whorl), more vertical, and much more laterally inclined; indeed it extends further back than the peristome.

"*Habitat.* Asadden River.

"Long. $8\frac{1}{4}$; diam. 5; apert. (intus) 2 mill."

In J. A. S. B. 1881, p. 148, Nevill writes:—"I have nothing to add to my above given description of this very distinct species, but it is necessary for me to correct my altogether mistaken reading of the original label of the locality sent me by its discoverer Surgeon-Major R. Hungerford. It should read: Hsaddenkoo, Salween Valley."

PUPINA NICOBARICA, Pfr. (Plate LXIX. fig. 8.)

*Registoma nicobarica*, Pfeiffer, P. Z. S. p. 145 (1852).
Gray, Phan. p. 104 (1852).
Adams, Gen. p. 289 (1858).
Pfr. Mon. Pneum. vol. i. p. 147 (1852).
*Pupina nicobarica*, Conch. Icon. pl. iii. fig. 26.
Nevill's Hand-list, p. 999 (1878); ditto, emended.

Under this name Nevill gives two varieties, see 'Mollusca of the Andaman and Nicobar Islands':—

Var. *nana*, Nevill, MS., G.-A. P. Z. S. 1895, p. 455.
Long. 4·6, diam. 2·5 mm.
Var. *evertata*, Nevill, MS., G.-A.
Both in the Calcutta Museum, from Great Nicobar.
Var. *albina*, Nevill, MS. in coll. De Roepstorff.

Original description:—"P. *testa imperforata, ovato-conica, solidula, glaberrima, nitida, pallide isabellina; spira convexa, sursum conica, acutiuscula; sutura lineari; anfr.* 5, *vix convexiusculis, ultimo oblique descendente, antice breviter ascendente, basi rotundato; apertura subverticali, circulari, nodulo calloso minuto juxta insertionem marginis dextri coarctata; perist. simplice, vix expansiusculo, margine columellari subincrassato, incisura brevi, subascendente a basali separato.*

"Long. 6, diam. 3 mill.

"From the Nicobar Islands."

Genus Sagdinella, Mörch = *Pupina*, juv.

As I have pointed out in 'Land and Freshwater Mollusca of India,' p. 45 (1882), the genus *Sagdinella* of Mörch will not stand; his *S. didrichensii* turns out to be an operculated form. There are some twenty specimens in Mr. de Roepstorff's collection, in seven of which I detected the operculum. This is multispiral, of about 4 whorls, and very thin; further examination showed that the shells were young *Pupinæ*, the operculum also corresponded. In some shells of *P. nicobarica*, and in the white variety *albina*, distinct transverse fine ribbing is seen, and on breaking a mature shell back to the same number of whorls as in so-called *Sagdinella* a precisely similar form of shell was presented. Moreover, this *Pupina*, at the commencement of the fifth whorl, contracts very considerably, and the shell is perforate at this stage. On turning to the original description I see that Professor Mörch described it from a single example, and I can quite understand his being misled by this peculiar young form, so very unlike the typical mature shell of *Pupina*. I note that in this white very thin variety every gradation can be seen, from shells quite smooth and glassy to others most distinctly ribbed. The drawing of *Sagdinella didrichsenii* given on pl. ix. figs. 1, 1 *a*, in 'Land and Freshwater Mollusca of India,' was made from the type specimen sent to me from the Copenhagen Museum.

## EXPLANATION OF PLATE LXIII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*. | *Alycæus busbyi*, G.-A., × 4. | Andaman. |
| 2, 2 *a*. | —— *rubinus*, G.-A., × 4. | Upper Burmah. |
| 3, 3 *a*. | —— *dohertyi*, G.-A., × 7. | Upper Burmah. |
| 4, 4 *a*. | —— *subculmen*, G.-A., × 7. | Naga Hills. |
| 5, 5 *a*. | —— *birugosus*, G.-A., × 7. | Khasi and Munipur Hills. |
| 6. | —— *granum*, G.-A., × 7. | Eastern Naga Hills. |
| 7, 7 *a*, 7 *b*. | —— *ochraceus*, G.-A., × 7. | Upper Burmah. |

## EXPLANATION OF PLATE LXIV.

| | | |
|---|---|---|
| Fig. 1. | *Diplommatina decorosa*, G.-A., × 7. | Anghami Naga Hills. |
| 2. | —— *ambigua*, G.-A., × 7. | Munipur Hills. |
| 3, 3 *a*. | —— *garoensis*, G.-A., × 7. | Garo Hills. |
| 4. | —— *commutata*, G.-A., × 7. | Lahupa Naga Hills. |
| 5. | —— *tumida*, G.-A., × 7. ? Typical. | N. Cachar Hills. |
| 6. | —— *elongata*, G.-A., × 7. Type. | Naga Hills. |
| 7. | —— *tumida*, G.-A., × 7. | Munipur. |
| 8, 8 *a*, 8 *b*. | —— *chennelli*, G.-A., × 7. | Lhota Naga Hills. |
| 9. | —— *butleri*, G.-A., × 7. | Munipur Hills. |

## EXPLANATION OF PLATE LXV.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Diplommatina dohertyi*, G.-A. | Margarita, Eastern Assam. |
| 2, 2 *a*. | —— *thomsoni*, G.-A. | South Burrail Range. |
| 3, 3 *a*. | —— *nengloensis*, G.-A. | North Cachar Hills. |
| 4, 4 *a*, 4 *b*. | —— *distincta*, G.-A. | North of Burrail Range. |
| 5. | —— *khunhoensis*, G.-A. | Khunho Peak, Naga Hills. |
| 6, 6 *a*. | —— *lapillus*, G.-A. | Lahupa Naga Hills. |
| 7, 7 *a*. | —— *compacta*, G.-A. | Munipur Hills. |
| 7 *b*. | —— *compacta*, G.-A. | Asalu, North Cachar Hills. |
| 8, 8 *a*. | —— *jatingana*, G.-A. | North Cachar Hills. |

## EXPLANATION OF PLATE LXVI.

| | | |
|---|---|---|
| Fig. 1. | *Diplommatina unicrenata*, G.-A., × 7. | Eastern Naga Hills. |
| 2. | —— *animula*, G.-A., × 12. | Lahupa Naga Hills. |
| 3, 3 *a*. | —— *subrubella*, G.-A., × 7. | Japvo Peak, Naga Hills. |
| 4. | —— *subtilis*, G.-A., × 12. | Margarita, Assam. |
| 4 *a*. | —— ——, × 7. | |
| 5. | —— *delicata*, G.-A., × 12. | Eastern Naga Hills. |
| 6. | —— *munipurensis*, G.-A., × 12. | North Munipur Hills. |
| 7. | —— *venustula*, G.-A., × 7. | Japvo Peak. |
| 7 *a*. | —— ——, × 12; side view. | |
| 8. | —— *domuncula*, G.-A., × 7. | Margarita, Assam. |
| 9. | —— *succinea*, G.-A., × 12. | Anghami Naga Hills. |
| 10. | —— *concinna*, G.-A., × 12. | Naga Hills. |
| 11, 11 *a*. | —— *japvoensis*, G.-A., × 7. | Japvo Peak, Anghami Naga Hills. |
| 12, 12 *a*. | —— *gibberosa*, G.-A., × 12. | North Munipur Hills. |
| 12 *b*, 12 *c*. | —— ——, × 7. | |

## EXPLANATION OF PLATE LXVII.

Fig. 1. *Otopoma naticoides*, Récluz, ♀, × 1·2. Socotra.
1 *a*. Ditto: removed from shell, right side.
1 *b*. Ditto: viewed from front, showing divided foot, × 2·6.
2. Ditto: branchial chamber with sides removed, showing position of the male organ and rectum, × 1·4.
2 *a*. Ditto: the same parts further enlarged, showing the anal aperture, × 4·5.
2 *b*. Ditto: the lower side of male organ showing the sperm-opening.
3. Ditto, ♀: showing the anal aperture and position of female orifice (*f.or.*).
4. Ditto: part of radula, × 58.
4 *a*. Ditto: first tooth on right side, × 163.
4 *b*. Ditto: second and third teeth on right side, × 163.
5. Ditto: buccal mass viewed from left side, × 4·5.
5 *a*. Ditto: buccal mass viewed from below, showing the salivary glands.
6. *Otopoma clathratulum*, Récluz, var. *minor*, G.-A., × 4·5. Socotra. Animal from spirit-specimen, right side view, showing the position of the penis.

*P.*, penis; *An.*, anus; *o.*, operculum; *An.or.* anal orifice; *f.or.*, female orifice; *t.*, tentacula; *P.ap.*, penis aperture; *r.m.*, retractor muscle; *sal.gld.*, salivary gland.

## EXPLANATION OF PLATE LXVIII.

*Cyclophorus* (*Natalia*) *wahlbergi*, Benson. Natal.

Fig. 1. Animal viewed from right side, ♂, × 4.
1 *a*. Ditto, view from front and above, showing position of the male organ and anal orifice, × 4.
1 *b*. Ditto, front view of head, showing form of mouth, × 4.
1 *c*. Ditto, scar of the operculum, ×4.
1 *d*. Ditto, free end of the male organ, as seen on slide with transmitted light, × 12·4.
2. Operculum, exterior side, × 2·5.
2 *a*. Ditto, side view, posterior side to right hand, × 2·5.
3. Buccal plates, × 8. *p.*, posterior side; *a.r.*, anterior right side.
3 *a*. Buccal portion showing the platelets, × 275.
3 *b*. Buccal portion near the central edge, where the rows of platelets are given off, × 275.
4. Radula, × 163.
4 *a*. Ditto, × 163.

*Cyclophorus* (*Cyclohelix*) *crocatus*, Born. Andaman Islands.

Fig. 5. Animal, right side, showing position of the penis, × 4.
5 *a*. Ditto, from left side, × 4.
5 *b*. The scar of the removed operculum, × 4.
6. Operculum, exterior side, × 2·5.
6 *a*. Ditto, side view, inner side to right, × 4.
7. Buccal mass and salivary glands, × 4.
8. Radula, × 58.

*o.*, operculum; P., male organ; *An.ap.*, anal aperture; *t.*, tentacula; *l.t.*, left tentaculum; *b.*P., base of male organ; *r.m.*, retractor muscle; *sal.gld.*, salivary gland.

## EXPLANATION OF PLATE LXIX.

Fig. 1, 1 *a*. *Pupina arula*, Bs., from type in Benson collection, Cambridge, × 4. Burmah.
2, 2 *a*, 2 *b*. —— *blanfordi*, Theob., from supposed type in British Museum, × 8. Burmah.
3, 3 *a*, 3 *b*, 3 *c*. —— *peguensis*, Bs., × 4. Kamah, Pegu.
3 *d*. —— ——, operculum, × 12·4; underside, × 12·4.
4, 4 *a*, 4 *b*. —— *limitaneus*, G.-A. Eastern Shan Plateau.
5, 5 *a*. —— *tongupensis*, G.-A., × 8. Arakan Hills.
6, 6 *a*. —— *artata*, × 8. Moulmain.
6 *b*. —— ——, another specimen, viewed from left side, × 8. Moulmain.
7. —— *hungerfordi*, × 4. Hsaddenkoo, Tenasserim.
7 *a*. —— ——, aperture, × 8.
8. —— *nicobarica*, × 8. Andaman.

## SUPPLEMENT TO PART VII.

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Since describing the new subgenus *Natalia* at p. 22, Plate LXVIII., Mr. E. R. Sykes has been good enough to point out that the name has been used before by Gray in Echinoderms in 1840. I therefore rename it "*Hijabia*," from the Arabic word "hijab," *concealment*, having reference to its shy habit. I am also enabled to give a fuller description of the animal from life, for Mr. John Ponsonby having received several living specimens in July, he very kindly forwarded them to me, for which I cannot thank him too much. Six of these are still living while writing in December. With the advent of the cold weather they have become very sluggish. They have never been very active, retiring into their shells on the slightest touch, and remaining there for a long time before venturing out again. When under examination they appeared to possess a higher degree of sensibility of disturbance of their surroundings than is usual in land-shells.

The animal is a very pale grey, almost white, the surface smooth, while, in remarkable contrast, the tentacles are yellow in colour. In form the tentacles are not at all like those of the Asiatic *Cyclophori*; they are not annulated, when contracted are broad at the base and blunted, and when fully extended are not so sharply and finely pointed, being soft and weak in structure. The eye is situated upon a convex prominence at the outer basal side. The foot is rounded behind, just extending beyond the circumference of the operculum; when moving about it is often spread out into an extremely thin flat disc. The edge of the mantle is turned back, and just overlaps the thin peristome on the outer margin. The only thing they fed upon kindly was cucumber, and now turnip; lettuce they did not appear to care for.

# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA,

INCLUDING

SOUTH ARABIA, BALUCHISTAN, AFGHANISTAN, KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM, MALAY PENINSULA, CEYLON, AND OTHER ISLANDS OF THE INDIAN OCEAN.

SUPPLEMENTARY TO MESSRS. THEOBALD AND HANLEY'S

CONCHOLOGIA INDICA.

BY

LIEUT.-COLONEL H. H. GODWIN-AUSTEN,

F.R.S., F.G.S., F.Z.S., &c.,

LATE DEPUTY SUPERINTENDENT TOPOGRAPHICAL SURVEY OF INDIA, IN CHARGE OF THE KHASI, GARO, AND NAGA-HILLS SURVEY PARTY.

VOL. II.

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# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA.

## VOL. II.

**Part VIII.—JANUARY 1898.**

(Plates LXX.–LXXXII.—*January* 1898.)

Family ZONITIDÆ (*continued*).

*Further Notes on the Genera and Species described or referred to in Volume I.*

Microcystina moerchiana, G.-A. (Nevill, MS.) (Part I. p. 13, Plate III. fig. 9), is No. 139 of Nevill's 'Hand-list,' p. 36.

Also from north coast, Great Nicobar (*coll. Wood-Mason*).

Microcystina warnefordi, G.-A. (Nevill, MS.) (Part I. p. 13, Plate III. fig. 8).

Jaw very curved, central projection well developed. Animal black, with well-developed right shell-lobe, and large lobe over the mucous gland.

Kaliella nana, Hutton (Part II. p. 21, Plate V. figs. 6, 6 *a*).

I have one specimen from Keylang, Kulu, from Ferd. Stoliczka.

Sitala haroldi, G.-A. (Part II. p. 33, Plate X. figs. 7, 7 *a*).

*Sitala haroldi*, G.-A. P. Z. S. 1895, p. 448, "List and Distribution of the Land-Mollusca of the Andaman and Nicobar Islands."

This species is No. 200 of Nevill's 'Hand-list,' p. 41; his

*Microcystis stewartiana*, MS., but never described. Nevill gives its locality as Little Brother Andaman and Katchall, from De Roepstorff. No. 208 in the 'Hand-list,' from Batte Malve, Nevill thinks is the same species.

Sitala phulongensis, G.-A. (Part II. p. 34, Plate X. fig. 4).

The lingual ribbon of this species is of the type of *Durgella levicula*, having a minute central tooth with a very great number of similar multicuspid laterals; the jaw almost straight. This is a very remarkable common character, also occurring in *Sitala infula* and *S. attegia* (see Part II. pp. 26–30). This leads me to consider the proper place of the genera *Sitala* and *Kaliella* to be after the Helicarioninæ, and that it is quite possible for forms with close-wound pyramidal shells to be not far distantly related to those that are open-wound, depressed, and globose.

Sitala rimicola, Bs., var. (Part II. p. 37, Plate IX. figs. 4–4 *c*).

I have examples from near the Burrowli River, Durrang, Assam; Dunsiri Valley, North Cachar Hills, Munipur; the Anghami Naga Hills, Lhota Naga Hills, and the Garo Hills.

Sitala febrilis, W. T. & H. F. Blanford (Part II. p. 38, not figured).

There is a specimen in the late Mr. H. F. Blanford's collection (in a letter, dated 11th October, 1891, received from him).

Sitala ? balliana, G.-A. (Nevill, MS.) (Part III. p. 74, Plate XV. fig. 2), is No. 193, *Nanina* (*Microcystis*), n. sp., of Nevill's 'Hand-list,' p. 41 (type).

Macrochlamys ? anonæ, G.-A. (Part III. p. 91, Plate XIV. fig. 8), is No. 163, n. sp., unnamed, of Nevill's 'Hand-list,' p. 38.

Macrochlamys ? choinix (Part IV. p. 102, Plate XXII. figs. 6, 6 *a*.)

"Animal very active; throughout black, except sole of foot, which is white" (*Nevill*).

Macrochlamys choinix, var. gigantea, Nevill, MS.

From South Andaman. In Nevill's emended 'Hand-list' this is catalogued as ? a distinct species.

"Collected by F. A. de Roepstorff. Diam. 19·25; alt. 10·25 mm." I have not seen an example of this shell.

Macrochlamys prona, Nevill (Part IV. pp. 103 & 111, Plate XXII. figs. 2, 2 *a*).

Thanks to Lieut. F. Howard, R.E., for kindly collecting some shells at Paurhi, in Gurhwal, N.W. Himalaya, I am able to supply the description of the odontophore in this species. The animal is

black; it was not well preserved, but the shell-lobes were seen. The specific distinctness of this shell is well established, as compared with somewhat similar glassy shells from the Gangetic plain.

The centre teeth are long, cuspid on the outer side; the laterals bicuspid, inner point the longest; the ten or twelve outermost are very small:—

30 . 2 . 10 . 1 . 10 . 2 . 30
42 . 1 . 42

The jaw is moderately curved, with a small central projection. (Compare this with radula of *M. hardwickei*, Vol. I. p. 106.)

Macrochlamys lhotaensis, G.-A. (Part IV. p. 107, Plate XXIII. fig. 5).

=*M. marshalli*, Tryon.

My specific name will not stand, having been used before for a *Kaliella* (Part II. p. 22). Tryon points this out, and altered it as above in his 'Manual of Conch.' pt. ii. (Zonitidæ) p. 101 (1886).

Macrochlamys? resplendens, Phil. (Part IV. p. 109, Plate XXVI. fig. 1).

There is no longer any doubt as to the true generic position of this shell, as I have since received some well-preserved specimens from Mergui.

The right shell-lobe is well developed, as is also the left, of same shape and position as in the typical species. The neck-lobes are small.

The male organ has a strong retractor muscle and a very long flagellum-like kalk-sac. The amatorial organ is large, and the dart bent below near the point, as in *M. hardwickei* (Vol. I. Plate XXVIII. fig. 1 *a*); it terminates in a blunt muscular point, the "Knorpel-papille" of Semper. The spermatheca is very long, with a small pear-shaped end, its length bearing a relative proportion to that of the flagellum and the spermatophore when it is formed.

The radula formula is

42 . 2 . 10 . 1 . 10 . 2 . 42
54 . 1 . 54

Central tooth long, narrow, and pointed, with two blunt not well-developed cusps at the base; the medials are also long and pointed, with one outer basal cusp; the laterals are bicuspid, the inner point being the longest; they become very long and curved, and diminish rapidly to the margin of the lingual ribbon. Jaw not seen.

This species and my *M. atricolor* (see Part IV. p. 113) of the North Cachar Hills, Munipur, and Northern Burmah, have been considered by some conchologists as one and the same. Under *M. atricolor* Tryon, in his 'Manual of Conchology,' 2nd ser. pt. ii. (Zonitidæ) p. 92, remarks, "is closely allied to *resplendens*, Phil.; perhaps a mere variety of that species." I always considered the differences

in the shells sufficiently well marked, but I would call attention again to what I have written on the top of p. 116, Part IV. *M. atricolor* departs from true *Macrochlamys* in the absence of the true shell-lobe and differently constructed left neck-lobe. Nothing can be more distinct than this: and although there is nothing very different in the form of the teeth of the radula, yet the proportion of centrals and laterals is not the same (see Part IV. p. 115).

A very similar departure from *Macrochlamys* is to be found in *stephus*, Benson, of the Andamans, where the left shell-lobe is absent, the mantle being turned back as a narrow border over the edge of the peristome, while there is a corresponding change in the neck-lobe. We have here a character of more than specific value, as I have said before; previous to establishing it as such, we require more material to work with.

Macrochlamys koliaensis, G.-A. (Part IV. p. 119, Plate XXVI. figs. 5, 5 *a*).

Mr. Tryon (Man. Conch., Zonitidæ, p. 101, 1886) points out that this name has been used before, and he has substituted that of *godwini*.

Oxytes silvicola, W. Blanford (Part IV. p. 131, not figured).

The glandular extremity of the foot with no overhanging lobe. Pedal line well marked. The radula agrees with that of *O. orobia*, Bs.: formula 46 . 17 . 1 . 17 . 46 = 63 . 1 . 63.

Austenia planospira, Benson (Part IV. p. 149, Plate XXXVI. figs. 1–5 *d*, & Plate XXXVIII. figs. 1–1 *b*).

In a paper "On the Distribution of Indian Terrestrial Gasteropoda," Theobald (J. A. S. B. 1863, pp. 365–369) places *Vitrina planospira*, Bs., of Sikkim in the genus *Cryptosoma*, but on insufficient grounds.

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## Genus Cryptosoma, Theobald.

(*Continued from* Part I. p. 14, Plate IV., 1882.)

This proves to be a good genus, and, with further material to examine, it is interesting to be able to extend the range very considerably. *Helicarion siamensis*, Haines, of which I obtained two specimens in very good preservation from Mr. R. Damon, undoubtedly belongs to it. Colonel R. G. Woodthorpe, R.E., C B., who made a very good collection of land-shells on his journey from the Shan States to the Mekong River in 1895, has added another species very distinct from *C. præstans*. Finally, Dr. Hungerford kindly gave me some specimens of *Helicarion imperator*, Gould, from Hong-

kong, and this proves in almost every main character to be similar to the typical species. Other species will no doubt be found in the intermediate countries of Annam, Tonquin, &c.

I should not be at all surprised if *Helicarion lowi*, De Morgan, from Perak, is closely related ; and it will also be interesting, when the animal of *Helicarion whiteheadi*, G.-A., from Borneo, comes to be examined, to see whether it will be included in this genus.

The first species now described was obtained about 300 miles to the N.E. of Moulmain.

CRYPTOSOMA INUSITATUM, n. sp. (Plate LXX. figs. 1–8.)

*Hab.* Eastern Burmah (*Colonel Woodthorpe*, 1894).

Shell (figs. 1, 1 *a*) globosely ovoid, fragile, with shiny surface; sculpture quite smooth, crossed by undulating lines of growth; colour dark reddish brown ; spire low, apex blunt, scarcely rising above the last whorl ; suture well marked ; whorls $2\frac{1}{2}$. the last very ample ; aperture very broadly lunate, oblique, inside white and nacreous ; peristome very thin, scarcely reflected, columellar margin rounded.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Size : | major diam. | 29·5, | minor diam. | 22·0, | alt. axis | 12·0 | mm. |
| Largest sp. { | ,, | 27·0 | ,, | 20·0 | ,, | 11·0 | ,, |
| | ,, | 25·0 | ,, | 19·5 | ,, | 10·0 | ,, |

*Animal* (fig. 3). The shell-lobes as in *C. præstans*, the left overlapping the edge of the peristome with a nearly equal breadth. It is conspicuously covered with large oval or circular flat tubercles, intermixed with smaller, some pale-coloured, others black, presenting a very mottled appearance. The neck-lobe is much smoother, but speckled ; the sides of the foot have here and there oblong dark spots.

*Generative organs* (fig. 7). The amatorial organ is a remarkably large, long, cylindrical mass, and differs from all the species I have examined in being attached by strong muscles for nearly its whole length to the right-hand side of the body from the generative aperture backwards, and has also a short strong retractor muscle at the posterior end, the position of the attachment being near the hepatic duct.

In this species this organ possesses great prehensile and retractile power. The analogue of the dart, which runs up the central axis, is a muscular hard-pointed rod, and was found protruding about 5 mm. outside the generative aperture (figs. 7 *b*, 7 *c*). The male organ has a kalk-sac just behind the junction of the vas deferens ; it there bends on itself with a strong diverticulum, whence is given off the retractor muscle ; the anterior rod has a blunt knob ; the spermatheca (*sp.*) unfortunately came to pieces on dissection, and could not be drawn with certainty, but it was elongate in form ; the albumen-gland (fig. 7 *a*) was flattened and ovate, composed of four very distinct segments, the hermaphrodite duct very much convoluted. The buccal mass (fig. 4) is short and globose behind ;

the radula is very broad, with 132 rows of teeth, arranged :—

140 . 3 . 17 . 1 . 17 . 3 . 140
160 . 1 . 160

In another I counted 165.

The teeth (figs. 6, 6 *a*) differ considerably from those of *C. præstans* from Moulmain. The central tooth is long, with the side cusps about halfway between the point and the posterior margin of the plate. The side centrals are broad with one outer cusp, none on the inner side; the outermost are on long and narrow bases, with short, bifid, rather rounded, bud-like points. The jaw (fig. 5) is curvilinear, with a well-defined central projection, thus differing from *C. præstans*.

A bottle containing several specimens of this species and a smaller form like *C. venustum*, sent me by Colonel Woodthorpe from the Shan plateau, was, owing to the weakness of the spirit, in such a state that no description or use could be made of them, but on looking them over I discovered a spermatophore in a fair state of preservation, only the side spines readily coming off. The membranaceous sac was short, 3 mm. long, or about one-third of the whole length; the spines are bifid, and set at intervals upon the long shaft (fig. 8).

The shell of *C. inusitatum* (figs. 1, 1 *a*) differs from *C. præstans* (figs. 2, 2 *a*) in being much more fragile and more depressed. The genitalia are on the same model, but the amatorial organ of *C. inusitatum* is larger. The greatest difference is found in the minor details of the jaw and radula, the jaw in *C. præstans* being very straight.

Cryptosoma siamense, Haines. (Plate LXXI. figs. 1–5 *a*.)

*Animal* (from spirit-specimen, through Mr. R. Damon). Shell and neck-lobes (figs. 2, 2 *a*) as in *C. præstans*, with this difference, that they are coarsely and evenly papillate throughout, giving them a shagreened appearance. The colour is darkish grey throughout as far as the pedal line, leaving the pedal margin distinctly paler. The foot is not so definitely divided.

The generative organs (fig. 5) do not differ very materially from the type of the genus. The amatorial organ is shorter and broader, and the spermatheca has a small, globose, free end. The vas deferens is short.

The jaw (fig. 3) is curved above, flatly concave on the cutting-edge, with no decided central projection. The central teeth are numerous and large, with a cusp on the outer side (fig. 4); about the 18th and 19th (figs. 4 *a*, 4 *b*) they become narrower and elongate; the 20th has no cusp; in the 21st its position is high up, just below the main apex; from the 22nd outwards all are bicuspid. The outermost laterals (fig. 4 *c*) are very narrow, with long basal plates with bicuspid bud-like points.

The teeth of the odontophore are arranged in 124 rows:—

170 . 3 . 17 . 1 . 17 . 3 . 170
190 . 1 . 190

The specimen here described was obtained from Mr. R. Damon, who had received it from Mr. Brot, of Geneva.

Original description (Ann. Lyc. N. H. New York, vol. vii. p. 158, 1858):—"*Testa depresso-globosa, tenui, lævigata, pallide cornea; spira vix elevata; anfr. 3, celeriter accrescentibus, ultimo inflato; apertura obliqua, coarctata, rotundato-quadrata; perist. simplici, margine columellari arcuato.*

"Diam. maj. 30, min. 24; alt. 15 mm.

"Habitat Siam."

CRYPTOSOMA IMPERATOR, Gould. (Plate LXXII. figs. 1–6 *a*.)

*Vitrina imperatrix*, A. A. Gould, Proc. Boston Soc. N. H. vol. vi. p. 422 (1859).

Several specimens, collected and preserved in spirit by Surgeon Dr. R. Hungerford at Hongkong, were given to me by that excellent ardent collector and conchologist. The best-preserved specimen measures 37 mm. in length; it is of an ochre colour, with indistinct blotchings on the foot above and on the sides. The foot is not keeled above, but rounded and rather flat near the posterior side of the shell (fig. 2 *a*); here it has a central well-defined groove, from which the lateral groovings on the side of the foot are given off. The extremity of the foot is cut off straight. There is no overhanging lobe to the mucous gland (fig. 2 *c*), the vertical cleft extending to the sole of the foot. The foot below has no central area marked off from the sides, so conspicuous in *C. præstans*, *C. inusitatum*, &c. The segmentation of the pallial margin is continued for about 2 mm. beneath the foot and ends irregularly. There is an indistinct peripodial row of oblong tubercles above the pallial margin (fig. 2). The right and left shell-lobes are well developed (figs. 1 *b*, 1 *d*, nat. size), and extend round and are connected at the posterior median side.

The generative organs (fig. 6) present a large amatorial organ, with a blunt rod and short spermatheca, while the penis (fig. 6 *a*) is very similar to that of the two preceding species.

The jaw (fig. 4) is arched above, concave on cutting-edge, the central portion nearly straight. The formula of the radula, which was not quite perfect on the outside:—

+ 65 . 4 . 11 . 1 . 11 . 4 . 65 +
+ 84 . 1 . 84 +

The central median teeth (fig. 5) as described in the last species. The 11th tooth (fig. 5 *a*) is very long and narrow, with the small tooth low down; on the 12th, 13th, and 14th it is just indicated; the 15th is quite straight; at the 16th the bicuspid teeth commence and gradually diminish in size to the outside (fig. 5 *b*).

Original description :—" *T. magnifica, fragilis, ventricosa, epidermide rigida fuscescente induta, obsolete spiraliter striata ; anfr.* 3 +. *Apertura ampla, subcircularis, ad columellam vix incrassata.* Axis $\frac{3}{4}$, diam. 1$\frac{1}{2}$ poll. (Plate LXXII. fig. 1.)

" Inhabits Hongkong in ravines near summits of hills.

" By far the largest species yet described ; approximates closely to *H. ampulla*, Bs."

Tryon (in Man. Conch. 2nd ser. vol. i. 1885) says : " the largest species of the genus." Perhaps belongs to same group as *H. præstans*, Gould. Westerlund has described, but not figured, a var. *imperatrix*.

And the following probably belong to the same genus :—

*H. cochinchinensis*, Morelet.

*H. birmanicus*, Phil. Diam. 9·3 mm.

*H. sumatrensis*, Schepman. Diam. 7·5 mm.

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It may be said with truth that the area embraced by the countries enumerated on the titlepage of this work is large enough to attack already without overstepping its bounds ; but in a generic sense I find it impossible to keep within its limits and, so far as I can attempt it, to give at the same time a clear elucidation of certain genera that are found within it and define the exact limits of their range. For example, there still seems to exist in the minds of some naturalists an idea that the genus *Girasia* and its allies are not separable from *Parmarion* and its allied forms. I shall therefore introduce into this Part descriptions and drawings of the genera *Damayantia*, *Parmarion*, and *Microparmarion*, to show the marked differences that exist between the slug-like forms of India and Burmah and those that have been found on the islands of the Malay Archipelago.

In an excellent paper by Dr. Heinrich Simroth on a new *Parmarion* genus, published in the work 'Zool. Ergebnisse einer Reise in Niederländisch Ost-Indien' (1893), he seems unwilling to acknowledge the priority of Gray's *Girasia* over Fischer's *Parmarion*, which, after all, was only by a few weeks. I was guided in my adoption of Gray's genus not on this account so much as by the fact of finding the true type of *G. hookeri* in the British Museum, while the exact type of *Parmarion* was doubtful, and was not likely to be discovered with the same certainty as to habitat ; in the case of *Girasia* its collector, Sir Joseph Hooker, was recorded. Still I did not lose sight of an important point which was known, viz. that the habitat of *Parmarion*, whatever the species might be, was restricted to Java.

The above valuable paper, and my own work among the Indian slugs, shows very clearly now that both these subgenera of the Helicarioninæ can be retained, and inhabit very well-marked areas, and it is happily quite immaterial when and by whom the generic terms were created. In the several details of their anatomy they

are very distinct. What *Limax problematicus* from Ceylon may be, or what its relationship—perhaps with *Mariella* or *Dekhania*—has yet to be cleared up, but we can consider *Parmarion* an essentially Malayan form.

Subgenus Damayantia. (Plate LXXIII. figs. 1–7 *d*.)

*Damayantia*, Issel, "Mollusca Borneensis," Annali d. Museo Civico Genova, vol. vi. pp. 389, 390, pl. iv. figs. 5, 6 (1874).

Type *D. dilecta*, Issel.

Original description:—"*Corpus elongatum, valde compressum, fuscum vel fulvo-lutescens, tuberculis rhomboideis parum elevatis nigrescentibus munitum, antice subtruncatum, postice perattenuatum; pallium breve, valde inflatum, ovato-rotundatum, paulum oblique depressum, fulvum vel fuscum, maculis nigris irregulariter aspersum, antice non adhærens; cauda gracilis, valde compressa, acute carinata, postice emarginata; solea angustissima, lutescens, longitudinaliter bisulcata.*

"Long. 24–17½ et 10½ mill."

The above description does not go beyond the external form of the animal, and it was not until 1894 that Mr. A. H. Everett, a naturalist who has done more than any man to give us a knowledge of the rich and beautiful molluscan fauna of Borneo, forwarded to Mr. Edgar Smith some specimens of slugs from that island. These were then examined in detail by Mr. Walter Collinge and myself, and the results were eventually published in the Proc. Zool. Soc. 1895, in a joint paper entitled "On the Structure and Affinities of some new Species of Molluscs from Borneo." The anatomy of *Damayantia* was taken from a species collected in the Poeh Mountains, Sarawak, and named by us *D. smithi*, after Mr. E. A. Smith, of the British Museum, who had so kindly let us have the material to work on.

I take the following amended and fuller generic characters from that species and give drawings of its anatomy:—

*Shell* (fig. 2). Broadly oval, with a slight indication (a mere impression) of the apical whorl, membranaceous and thin in texture, contracting and wrinkling when removed from the animal.

*Animal* (figs. 1, 1 *a*, 1 *b*). Where black markings exist on the shell-lobes they are concentrically arranged as regards the edge of the shell; they also cover in life the greater portion of the shell, as in Issel's figures.

The mantle differs very much from that of typical *Girasia*. The left shell-lobe has been developed to a greater extent than the right, and extends back behind the respiratory orifice, even posterior to the apex of the shell; on the left anterior margin a cicatricial line marks very distinctly where the shell and dorsal lobes meet. The left and right are continuous all round, the left being the larger. The foot posteriorly is long and narrow and sharply keeled. Foot-sole with a central area, distinct from the sides. Large linear

mucous pore (fig. 4) not extending to the foot-sole, the extremit yof the foot above slightly overhanging it.

*Anatomy.* On removing the shell the visceral mass (fig. 3) presents a single coil, the apical portion being distinct and blunt.

*Generative organs* (fig. 7). The penis (figs. 7 *b*, 7 *c*) is a thick, muscular walled tube; there is a lower sac-like portion, suddenly constricted and then dilating into a bulbous head. The very short but strong retractor muscle (*r.m.*) is attached here, and from the side of the bulbous head the vas deferens passes off as a thick tube, narrowing gradually as it approaches the common duct. The spermatheca (*sp.*) is a small ovoid sessile body. The hermaphrodite gland (fig. 7 *a*) is almost circular. The amatorial organ is a large, thick, muscular walled tube, making a single coil about the middle half, which would increase its elasticity and act like a spiral spring; just below this (*sp.am.*) is the calcareous dart (fig. 7 *d*); its basal portion is funnel-shaped, and the dart itself long and pointed.

The jaw (fig. 5) is straight and narrow, slightly concave on the cutting-edge, with a straight central portion.

The lingual ribbon (fig. 6) is broad and square, having a great number of equal-sized and similarly-shaped teeth in the row. It was incomplete in *D. smithi,* but showed +175 . 1 . 175+.

The central tooth is elongate, with three points, close upon the same level, *fleur-de-lis* in form, contracting below this and widening again at the base. The lateral teeth are all uniform, curved, very elongate, with two closely-set points, the outermost being rounded, the innermost sharp and pointed.

*Damayantia* is in every respect a most interesting genus, differing in many important particulars from *Girasia* and its allies of the Indian region. I give these differences verbatim from the paper in the Proc. Zool. Soc.:—

"1. The spiral form of the visceral mass is very noticeable, and we probably have here indicated a relationship with forms having a more perfect spiral shell. In *Girasia*, when the shell is removed, this is not apparent. The visceral sac is a globose mass.

"2. The form of the mantle-lobes indicates a relationship to some form in which the left shell-lobe has become largely developed along the whole mantle-edge together with the right, as displayed in *Girasia* and *Macrochlamys*, but in which last-named the development of the shell-lobes has been more equal and commenced at two distinct points.

"3. The position and form of the caudal mucous gland.

"4. The straight jaw.

"5. The broad lingual ribbon and the great number of teeth of a very different kind."

These last two characters we find in *Durgella*; they show a certain approach to the subfamily Durgellinæ.

In Issel's original description of external characters only, and his figures 4 and 6 of the type of the genus, *D. dilecta*, it is shown to have exactly the same peculiar concentric markings on the mantle as in *D. smithi.* Issel says, however, there is no shell, and this both

Mr. Collinge and myself considered was an oversight. These very thin membranaceous shells may easily escape notice; and further, in all the species from the Indian region a shell is always present, however membranaceous and small in size it may have become.

## Genus Parmarion, Fischer, 1855.

[Actes de la Soc. Linn. de Bordeaux, sér. 2, vol. x. p. 389, pl. xx.]

*Original description*:—" Bouclier adhérant au corps par une faible partie de son bord, étalé en avant en un grand lobe libre, entourant sur les côtés et en arrière presque toute la coquille, percé d'une ouverture dorsale, plus ou moins large, au-dessous de laquelle se montre le test. Sole du pied tripartie; pied tronqué en arrière, pourvue d'un pore muqueux; masse viscérale bombée en arrière et bien séparée du pied. Dents marginales bicuspidées.

" Coquille interne calcaire, mince, ovalaire, légèrement bombée, couverte d'un épiderme lisse qui la débord sur les côtés et en arrière et qui enveloppe la masse viscérale."

In the 'Manuel de Conchyliologie' (1887), from which the above is copied, Fischer makes the type *Limax problematicus*, Fér. = *P. pupillaris*, Humbert, of Ceylon, and goes on to say: " many species are described under the generic name of *Girasia*, Gray, 1855; but this genus, badly defined by its author, has been created for a medley of *Parmacella*, *Urocyclus*, or *Parmarion*. The true *Parmarion* would be Asiatic." Fortunately, Gray most clearly indicated his type, *G. hookeri*, as I have recorded before (Vol. I. Part VI. p. 216). When we consider the knowledge of his day, and the method in which a group like the slugs were approached, and the ideas on relationship which then prevailed, it is of minor importance what species were included under any given generic title, or whether they all corresponded with the type; descriptions were then usually confined to the external features alone, and even Fischer's description of *Parmarion* might be made to apply to many very different slugs, looked at superficially, but is not sufficient for the way in which they should be studied and their affinities worked out.

Simroth treats this genus with great care and detail, quoting the original and then Tryon's description, which also does not go beyond external characters. From Simroth's own description we first begin to understand what *Parmarion* of the island of Java really is, and that it differs essentially from *Girasia* (see his drawings of the anatomy of *P. pupillaris*, pl. viii. figs. 16 & 17; also my copy of Semper's rendering of the same on Pl. LXXIV. figs. 6, 6*a*). I cannot do better than quote his generic description of *Parmarion* and his new subgenus *Microparmarion*, type *M. strubelli*, Simroth, also from Java:—

*Parmarion*.—" Die Mantelkante springt stark vor. Die Schale ist einer zarte Kalkplatte, ähnlich wie bei *Limax*, mit einer kräftigen glänzenden Epidermis, die sichrects und links über den Rand,

fortsetzt. Der Liebesfeil ist am Ende in schrägen Schlitz geöffnet. Der Penis ist gerade gestreckt, sein Lumen entspricht in der Form seinem äusseren Umfange. Receptaculum gestielt."

*Microparmarion.*—" Die Mantelkante verwicht sich. Die dünne von glänzender Epidermis überzogene Schalenplatte hat (z. T.) an der unterseite noch einen Rest von Gewinde. Der Liebesfeil hat eine solide Kalkspitze. Der Penis ist ein dünner, in der geraden Scheide mehrfach zusammengekrümmter Schlauch, so dass das innere Lumen dem äusseren Umfange durchaus unähnlich ist. Receptaculum sitzend."

I illustrate the anatomy of *Microparmarion* with my original drawings (those in the P. Z. S. 1895 being copies of them) of two species from Borneo, *M. pollonerai* and *M. simrothi*, Coll. & G.-A., the latter being the nearest to *M. strubelli*, Simroth; the differences are quite specific.

No slug-like form from India and Burmah, as yet examined by me, possesses a calcareous *spicula amoris* or an amatorial organ like those figured by Simroth in his paper, and by myself on Plates LXXIV. & LXXV. The short sessile *receptaculum seminis* is also peculiar to the Malayan area, for even when somewhat lengthened as in *Parmarion*, it is usually a short sac as compared with the elongate large form met with in *Girasia* and *Austenia* (see plates xxv. & xxvi. P. Z. S. 1880; and Vol. I. Part 6, Pl. LXII. fig. 3 *b* of this work)—genera which appear to be the direct descendants of *Macrochlamys*. The spermatheca has, of course, a direct relationship to the form and length of the spermatophore. This organ has yet to be found in the Javan and Bornean species, and it will be interesting to see, when it is, what form it may present; it will doubtless be of further generic value. It may be of interest here to quote from the paper by Mr. Collinge and myself what a better knowledge of the internal anatomy indicated :—" . . . the most interesting result of the examination of these slug-like molluscs is their similitude internally to the similar parts of shell-bearing species which inhabit the same island of Borneo. A reference to the figures and description of the genera *Everettia* and *Dyakia* [*vide* paper by me in P. Z. S. 1891, 'On a Collection of Land-Shells made in Borneo by Mr. Everett'] will show that the calcareous dart peculiar to *Microparmarion* occurs in both of these genera, while the odontophore of *Damayantia smithi* agrees with that of *Dyakia* in a remarkable manner." My attention was first directed to this point of local resemblance when describing the Bornean subgenus "*Everettia*," P. Z. S. 1891. So far as my observation goes, it seems very probable that *Macrochlamys* does not extend to Borneo, and I expect the limit of its range may go no further east than Java*. In Borneo *Everettia* takes its place—a shell with a very different lineage; this is what I wrote at the time under *Everettia jucunda* :—

"This shell was placed by Von Martens in the genus *Macrochlamys*, and looking at its shiny glossy shell, so very like many in

* I have seen a species extremely like *M. resplendens* from that island.

the Indian region, I should certainly have done the same; yet the animal differs from that genus, not in one but in several characters —externally in the absence of the long shell-lobes; internally in the odontophore and jaw; and in the reproductive organs it is widely separable, *Macrochlamys* not possessing the *spicula amoris* (*i. e.* of the calcareous type). In searching through Semper's work for characters approaching those now figured and described, I observe the nearest, as might be expected, in those genera found in the islands of the Malay Archipelago, and not in those found to the westward in India. On plate iii. figs. 1 & 2, Reise im Archipel d. Philipp., is shown the *sagitta amatoria* of *Tennentia philippinensis* and *Parmarion pupillaris* from Java of the same type. This I would submit is an indication that the slug-like forms of this part of the world are the descendants of these glassy Helices, just as we find the general anatomy of *Girasia*, a slug-like species of India, to be like that of *Macrochlamys*, and that although the outward form of both animal and shell is very similar respectively, the races of the two areas have a most remote relationship. How far these characters of *Everettia* and *Dyakia* extend around this area is yet to be discovered. We cannot as yet say with certainty that shells with similar internal structure do not exist in India; they are certainly absent in the N.E. Himalayas and Khasi Hill Ranges, but there are numbers of even large species in Southern India and Ceylon yet to be examined, and of which we know as yet nothing. Of the shells of New Guinea we are also quite ignorant, at least I have not seen any work on their anatomical variations."

I have since then been able to obtain, through the kind aid of Dr. Thurston of the Madras Museum, several species from that neighbourhood and the Nilghiri Hills; they all present common characters very different to those of the Bornean species mentioned above. Finally in 1895, in the joint paper on Bornean molluscs, quoted before, the following paragraph concludes it:—"It seems to us that there can be little doubt but that the slug-like forms of Borneo have the same close relationship to the shell-bearing molluscs among which they are now found living, as the Indian forms bear to *Macrochlamys* and allied shell-bearing genera, and any true attempt at classification must be based on these lines, and would place a wide gulf between *Girasia* and *Austenia* on the one side, and *Parmarion* and *Microparmarion* on the other. Further, we think that future research will clearly show that many of the slugs cannot rightly be placed in families by themselves, but will find their true position before or after the genera they have descended from or developed into."

Since this was written, Mr. W. Collinge has recently read a paper at the Zoological Society giving descriptions of two other species of *Parmarion* from Lombok, Borneo, presenting specific differences of interest from those molluscs we before described. Neither depart from the *Parmarion* structure. The darts were not satisfactorily made out, and the lingual ribbon was not included in the descriptions. In *P. everetti* the *spicula amoris* was in all probability

lost by being broken; these darts are extremely brittle and most difficult to work out entire, they must frequently be broken off in the living animal or be in process of re-formation. Thus fig. 10 does not look quite complete. They are not always to be found near the vagina, but halfway up the sheath of the amatorial organ. The series of ridges in the penis of *D. intermedius* indicate, I think, a spermatophore in process of formation.

## Family ZONITIDÆ.

### Subfamily Durgellinæ.

### Genus Durgella. (Plates LXXVI., LXXVII., LXXVIII., LXXIX.) (*Continued from* p. 142, Part IV., 1883.)

I have since been able to examine the other species, *D. mairangensis*, alluded to on p. 145; but it becomes necessary in the first place, in order to show clearly the variation between this and other species, to give in this Part drawings and the description of *levicula*, Benson, the type of Blanford's genus, as well as those of *D. assamica*, G.-A.

Other allied species have in the interval since 1883 been discovered, showing that this very interesting group of the Land Mollusca is fairly well represented, though certainly not abundant in species, and that it has a considerable range.

Early in 1877, Mr. Ossian Limbourg was engaged to collect generally in Tenasserim, the expenses being shared by Lord Tweedale, Dr. John Anderson, and Mr. Wood-Mason, of the Indian Museum, and myself, then in Calcutta. Among the shells he preserved in spirit were a large number of *D. levicula*, found on the slopes of the Mulé-it Range near a place called Meetan; a number also reached Calcutta alive, which had been packed in a bamboo-tube, and I was thus enabled to make notes and sketches of the shell-lobes when naturally extended over the shell. I did not then attempt naming the collection until my return to England, and the determination of this species proved somewhat interesting and instructive. Mr. Benson's shells, after his death, passed, through his executors, into the charge of Mr. Sylvanus Hanley, who published figures of a very large number in the 'Conchologia Indica.' I am sorry to say there was a considerable absence of method in the prosecution of this work; it is not recorded whether a shell figured was a type shell or from the typical locality; nor was the shell selected to be drawn labelled as having been so, nor out of whose collection it was selected. Although Mr. Hanley was a keen collector and conchologist, and had worked with Edward Forbes, he was lacking in the sense and appreciation of exact

geographical record, which will preserve and protect, with the religious feeling for a relic, original labels. He never, I think, comprehended the great area India comprised, and the great and varied physical differences the country presents.

Benson's shells were finally purchased by Mr. MacAndrew, and are now, many of them, in the Cambridge Museum, incorporated in the MacAndrew collection, and generally have "from Benson collection" written on the new label, with India, Bengal, or Burmah as habitat: but I regretted to find Benson's original labels, in his unmistakable writing, had been destroyed, and with them had gone all his valuable record of exact locality; this fault, however, does not rest, I am glad to say, on the Cambridge Museum. I can remember seeing many species still gummed on the original cards when in Hanley's charge. The original value of many of the species is lost for ever, and a good many have no locality at all, and several typical shells are no longer there. I found two specimens of *H. levicula* in the collection from Tenasserim, one of which must be the type shell referred to from Phie Than, and I was so far enabled to compare and identify Mr. Limborg's specimens.

DURGELLA LEVICULA, Benson. (Plate LXXVI. figs. 1, 1 *a*, 1 *b*.)

*Helix levicula*, Benson, A. M. N. H. ser. 3, vol. iii. p. 391 (1859); Pfeiffer, Mon. Helic. vol. v. p. 48.

*Durgella levicula*, W. T. Blanford, A. M. N. H. ser. 3, vol. xi. p. 81 (1863).

*Macrochlamys levicula*, sec. D, Theobald, Suppl. Cat. p. 19 (1876).

*Helix levicula*, Conch. Ind. p. 37, pl. xc. figs. 1, 4 (1870).

*Nanina levicula*, Nevill, Hand-list, p. 26 (1878). From Basein, Thyetmyo, and Pegu.

*Durgella levicula*, Godwin-Austen, Proc. Linn. Soc., Zool. vol. xv. p. 291 (1881).

*Durgella levicula*, Tryon, Man. Conch. vol. xi. p. 111, pl. xxxvii. figs. 8, 9 (1886).

Original description:—"*Testa angustissime perforata, globoso-depressa, tenui, oblique striatula, striis spiralibus, obsoletis sub lente vix decussata, polita, subdiaphana, luteo-cornea; spira convexiuscula, apice vix elevatiusculo, obtuso, sutura impressa, marginata; anfractibus 3, celeriter accrescentibus, ultimo antice majori, subtus convexo-subconoideo, peripheria superne subangulato-rotundata; apertura obliqua, magna, rotundato-quadrato-lunari, peristomate acuto, superne antrorsum arcuato, margine columellari subverticali, superne breviter reflexo, umbilicum subtegente, basali leviter arcuato.*

"Diam. major 7, minor $5\frac{1}{2}$, axis $3\frac{1}{2}$ mill.; apert. 4 longa, $4\frac{1}{2}$ mill. lata.

"Habitat Phie Thán, raro occurrens.

"Described from a single specimen in Mr. Theobald's collection. Were it not for the presence of the perforation, the shell might be easily ascribed to *Vitrina*. It has close relations with two species,

which are nevertheless quite distinct, collected in Pulo Penang by Dr. Cantor, and by Dr. Jerdon in Southern India."

*Locality.* Meetan, under the Mulé-it Range, Tenasserim: very abundant (*O. Limborg*).

Shell very narrowly perforate, ovately globose. Sculpture smooth on last whorl, with regular shallow ribbing under a strong lens; the apical whorls are regularly and finely striate, crossed by fine oblique ribbing, and almost decussate. Colour, when living, pale greenish ochre, whitish towards the apex; with animal removed, very pale ochraceous. Spire low, convex. Suture rather shallow. Whorls $3\frac{1}{2}$ to 4, adpressed, well rounded. Aperture broadly ovate, oblique. Peristome thin; columellar margin rounded, slightly reflected, not at all solid.

Large specimen: major diam. 9, minor diam. 7·2, alt. axis 4·5 mm.; diam. aperture 5·7, alt. aperture 5·0 mm. The ordinary size is 7·0 major diameter.

*Living animal.* Pale ochre, with a dusky line on the upper part of the extremity of the foot, also on the neck; tentacles moderately long; foot with mucous gland (Plate LXXVI. fig. 2 *b*), lobe over it moderate. A broad tongue-like expansion (*r.s.l.*) on the right side of the aperture, another on the left margin of the mantle (*l.s.l.*) which is reflected over the edge of the peristome and widens out into a broad flap. Left neck-lobe (*l.d.l.*) moderate. The length of the animal with a shell 0·4 in major diameter was 0·75 inch. Figs. 2 and 2 *a* show the shell and dorsal lobes of a specimen preserved in spirit.

The pallial fringe is very wide, the pallial line remarkably distinct, between two parallel grooves. The foot below has a distinct central area about one-third the breadth; the margins of the foot regularly segmented, both on the outside and viewed from below.

*Generative organs* (Pl. LXXVI. fig. 6). Neither the ovo-testes, hermaphrodite duct, nor albumen-gland have I been able to make out in the spirit-specimens.

The spermatheca (*sp.*) is short, thick, and wide at the base, with a narrow neck above and a swollen round terminal portion (vide *Conulema*, Stoliczka). The amatorial organ is large and cylindrical, being twisted in form from its position in the spire of the shell; at the anterior end it terminates in a well-developed pointed knob. At the posterior end is a retractor muscle; it swells out rapidly and narrows at about half the total length. Viewed by reflected light (fig. 6 *a*) the homologue of the dart is well seen, a long, cylindrical, hard, muscular organ occupying the centre, thick at the posterior end, and terminating fine and pointed. In the male organ the vas deferens joins it close below the retractor muscle; it is thickened and convolute just below the actual junction, thence from the retractor forwards it is a long ample sheath.

The buccal mass is short in length, very globose in shape, and rounded at the back. The jaw (fig. 4), shown very much enlarged, is 0·044 in. in length, very thin and membranaceous, nearly straight on the edge, with a very slight rise in the centre, convex above;

muscular impressions striate from side to side, arched sharply over the central portion.

The radula is very broad; the central tooth (fig. 5) is very minute, and so hidden by the larger laterals that I have only been able to see it once. The lingual ribbon is extremely brittle, and generally parts upon the central line. It becomes very difficult to see the whole side at once and count the teeth; and I have not been able to count the exact number of rows, but they are considerably over a hundred. The laterals (fig. 5 *a*) are all similar, minutely pectiniform, on a curved edge, very closely set together, and exceedingly numerous, very gradually decreasing in size to the outer edge; they are packed much closer than those shown in fig. 5 *a*.

+170 . 1 . 170+

Their extreme minuteness is shown by four medians occupying only 0·0005 inch; five laterals the same space.

This form of radula suggests a scouring habit of feeding; its breadth and evenness of surface working over a large area, and into the irregularities of the surface of rocks and stones covered with confervoid growth, would enable the animal to collect its food more rapidly; whereas in other genera the far larger central teeth present a less yielding narrower surface, one better fitted to be a leaf-rasping instrument.

Durgella assamica, Godwin-Austen. (Plate LXXVII. figs. 1–6.)

*Durgella assamica*, G.-A., Journ. Linn. Soc., Zool. vol. xv. p. 294 (1881).

*Locality.* Panipputer Tea-garden near Tezpur, Assam (two specimens from Mr. Lumsden).

*Original description*:—"Shell (fig. 1) very thin and membranaceous, imperforate, depressedly conoid. Sculpture quite smooth, with some slightly indistinct, oblique, shallow ribbing on the third whorl. Colour olive-brown. Spire depressed. Suture impressed. Whorls 4, rather rapidly increasing. Aperture ovate, oblique. Peristome very thin, columellar margin not at all thickened.

"Size: major diam. 9·5, minor diam. 8·2; alt. axis 4·4 mm."

*Animal.* The overhanging lobe to the mucous pore is largely developed. The pallial line (fig. 2) is distinctly marked by a double row of oblong segmental divisions formed by three parallel appressed lines or grooves, crossed at intervals by the main radiating grooves leading to the dorsal side. The mantle-lobes, shown detached from the body (fig. 3), are as in *D. levicula*, only that the left dorsal lobe is divided into two distinct parts at about the middle of its length, and the left shell-lobe shows that about the middle it is expanded and much lengthened into a tongue-shaped process, for in the drawing it is shown unevenly contracted by the spirit.

*Generative organs* (fig. 6). The albumen-gland is pear-shaped and well developed, with an expansion near the junction of the hermaphrodite duct. The oviduct was greatly swollen and enlarged,

but, as usual, not well preserved. The spermatheca is longer than in *D. levicula*, with the same swollen posterior termination and narrow median neck. The penis is a long, gradually tapering sheath as far as the retractor muscle; there is then a short swollen portion joined by the vas deferens. No amatorial organ was found in either of the two specimens examined.

The odontophore (figs. 5, 5 *a*) is as in *D. levicula*; the central tooth was not seen. The jaw (fig. 4) is very straight in front, thin, flatly convex above, rather narrow. The striate lines of the muscular attachments form a broad arch over the central part of the cutting-edges.

In the absence of the amatorial organ we have a most interesting correspondence with what Ferdinand Stoliczka has recorded on the anatomy of *Conulema*=*Sitala* (J. A. S. B. vol. xl. pp. 236–241, pl. xviii. 1871), where he found it present in *S. attegia*, Bs., from Burmah, not so in *S. infula*, Bs., the Bengal or Indian form, and I quoted this in Vol. I. p. 28, and, as will be seen further on, it is absent in *D. christianæ* of the Andamans. This I take to be another indication of the close relationship of the genus *Durgella* and *Sitala* in the two areas; for we find that *D. assamica* bears exactly the same relationship to *S. infula* as *D. levicula* does in Burmah and Tenasserim to *S. attegia*—modification from some older and more widely distributed form having gone on in the two areas. But it would not, as Stoliczka says, be expedient, on this single point of structure alone, to place *attegia* and *infula* in different genera. On the contrary, it will be more in accordance with strict classification to bring *Durgella* and *Sitala* together, in spite of the very different and conchologically extreme form of their shells.

Taking shell-character alone, it would have been supposed that *Helicarion bensoni*, from the neighbourhood of Calcutta, would resemble and be included in *Durgella*; such is not the case. In Vol. I. Part IV. p. 150, I have described this species, which is widely different, being of the type of *Macrochlamys*, subgenus *Austenia*.

Durgella mairangensis, n. sp. (Plate LXXVII. figs. 7–11.)

*Locality*. Mairang, North Khasi Hills (*Godwin-Austen*).

Shell (figs. 7–7 *c*) globose, very thin, shining; sculpture none, with some distant lines of growth; colour very pale straw; spire flatly conoid, outline rounded; suture shallow, adpressed; whorls 3, increasing evenly, rounded; aperture oblique, widely lunate, oblique on the columellar side, near the umbilicus very slightly thickened and reflected.

Size: maj. diam. 7·5, minor 6·0; alt. 3·75 mm.

This shell is very close to *A. salius*, Bs., of Teria Ghat, Vol. I. Pt. IV. p. 152 (Pl. XXXVII. figs. 1, 1 *a*, 1 *b*); it differs in form and size, and particularly in the proportion of the 2 apical whorls, which are much closer and smaller in a larger shell. It was taken alive and the following description written at the time:—Animal pale yellowish, rather more orange on foot; tentacles pale, short; a dusky line on upper surface of extremity of the foot: mucous gland small, overhanging; shell-lobes slightly reflected over edge of shell. Jumps about actively when handled. Shell pale green. Length

0·6 inch. This was put in a tube and dried up very well, and when soaked out I was enabled to make out the generative organs to the extent shown in fig. 11. The amatorial organ is present and is short and thick, and the spermatheca of rather short dimensions. The jaw (fig. 9) is rounded above, with a slightly concave cutting-edge. The radula (figs. 10, 10 *a*, 10 *b*) was like that of *D. levicula*, but the teeth are much larger, though serrated in the same manner, the central tooth being a single straight-sided point or spike; the side teeth have six well cut serrations. The formula was

320 . 1 . 320.

In my description of Benson's *Vitrina salius*, Vol. I. p. 152, I put it into the subgenus *Austenia* with a ?. Mr. Theobald's observation, recorded by Benson, of its jumping habits, which the animal now described also displayed, leads me to think that *salius* in all probability belongs to the genus *Durgella*, a point I trust may some day be cleared up. Some of the other and similar species figured on Plate XXXVII. may also belong to it.

Durgella christianæ, Theobald. (Plate LXXIX. figs. 1–5.)

*Vitrina christianæ*, Theobald, J. A. S. B. p. 245 (1864).

*Vitrina christianæ*, Hanley, Conch. Ind. pl. lxvi. figs. 7–10 (1870).

*Helicarion* (sec. C) *christianæ*, Theobald, Cat. L. & Freshw. Shells India, p. 24 (1876).

*Helicarion christianæ*, Nevill, Hand-list, p. 14 (1878).

*Durgella christianæ*, Godwin-Austen, A. M. N. H. p. 377 (Nov. 1881).

"Shell (original description) (fig. 1):—*Testa subglobosa, tenuis, polita, diaphana, nitida, supra costulate striata, infra planior, colore succineo; apice pallido, vix elevatiusculo; peripheria rotundata; apertura parum obliqua; anfractibus* $3\frac{1}{2}$, *lente crescentibus. Long.* 13, *lat.* 11, *alt.* 8 *millim.*

"Habitat in insulis Andamanicis.

"I have much pleasure in naming this shell after the lady of the present Governor of the Settlement, Lieut.-Col. Tytler, as a mark of esteem and pleasing remembrance of my sojourn at Port Blair in his hospitable mansion. It is of the same type as *V. bensoni*, Pfr., but is at once distinguished from all species I am acquainted with by its brown colour."

*Original description*, 1881:—"Animal [Pl. LXXIX. fig. 2] from spirit-specimen about $1\frac{1}{2}$ inch long when fully extended. Whole body very dark (probably indigo-grey), with the shell-lobes conspicuously pale-coloured. Apparently long, and foot narrow, with a distinct central area [fig. 2 *b*] and lateral pallial line. The right neck-lobe is small, dark-coloured, of triangular form, the left neck-lobe commencing as a very narrow strip at the respiratory orifice, and widening gradually, but to no great extent, towards the left side. The right shell-lobe is largely developed even as contracted in the spirit, and in life must extend over all the right and posterior side of the shell. The left shell-lobe is given off from the edge of the mantle on the left anterior margin, and is broadly tongue-shaped, in length

about four times its breadth, and must also cover a very large surface of shell when fully extended. The extremity of the foot is square, with a mucous gland overhung by a large lobe [fig. 2 *a*]. The generative orifice is just behind and a little below the right eye-tentacle [fig. 2]. The generative organs are the same as in *Durgella assamica*, there being no amatorial organ. The spermatheca is long and small, expanding at the end into a large pear-shaped sac. The albumen-gland is large and granular; but I failed to trace out the hermaphrodite duct and ovo-testes.

"*Odontophore* [figs. 4, 4 *a*, 4 *b*]. The buccal mass is large and broad, with a broad lingual ribbon, extremely brittle, so that I was unable to get it out complete; it consisted of rows of similar and equal-sized teeth; however, I was fortunate enough to secure the central portion. A very minute central bicuspid tooth [fig. 4], succeeded by much-curved bicuspid laterals, the first on either side of the central being slightly shorter than the second; thence and outwards there is no change in form, except that those further removed nearer the margin show the pectiniform edges so characteristic of the odontophore in *D. levicula* [fig. 4 *b*]. The jaw [fig. 3] is straight, with a slightly convex central margin, by no means of solid form, and longitudinally striate."

I was indebted to my friend Mr. Geoffrey Nevill for the first examples of this species in spirit sent to me in 1881, and afterwards to my brother Harold, of the Civil Service, who served for many years in the Andaman Islands. There is a large slug-like form yet to be collected there, for he described to me the finding of one on one occasion, when working his way on an elephant through the forest and jungle into the hills. Having nothing to put it in, it was wrapped up in a leaf, but it got swept off the pad and was lost. It is very desirable to obtain a coloured drawing of *D. christianæ* from life, and it is to be hoped some future malacologist visiting these islands will be able to do this. The species was first described on shell-character alone by Mr. Theobald. In his Catalogue of 1876 it is placed in a Section C of the genus *Helicarion*. The five sections into which this genus is therein divided are quite artificial, based on shell-characters, which in these slug-like forms are of no value whatever *.

Durgella ? sumbaensis, n. sp. (Plate LXXIX. figs. 6–8 *b*.)

*Locality*. Sumba or Sumbawa, Dongo Mountains, 4500–5000 feet (*Doherty*).

Shell depressedly globose; sculpture none, surface polished and glassy; colour pale greenish ochre; spire low; apex flatly rounded; suture shallow, adpressed; whorls 3, very rounded; aperture broadly lunate; peristome thin; columellar margin vertical, weak in structure, but slightly reflected.

Size: maj. diam. 5·75; alt. axis 3 mm.

Largest, broken: maj. diam. 9·0; alt. axis 3 mm.

* For instance, *H. bensoni*, to which *H. christianæ* is compared in the original description, is in all details of its anatomy closely allied to *Macrochlamys*.

The form of the shell is more like that of *Austenia* (? *Durgella*) *salius* of Teria Ghat, at the foot of the Khasi Hills, than any I am acquainted with (*vide* Vol. I. Pt. IV. Pl. XXXVIII. fig. 1), but the Sumba shell is more globose. The anatomy of *A. salius* has never been described and is a desideratum. For this we must wait some time, I fear, as only a very keen collector of these small molluscs will take the trouble and discomfort of the search, which to be successful must be made at the height of the rains, in sweltering heats, and amid innumerable leeches.

After soaking the specimen which contained the dried-up animal I was enabled to make out the following interesting points of structure:—Animal is very pale in colour; above the mucous gland there is a long overhanging lobe, recalling the similar process in Semper's genus *Macroceras* of Samar, Cebu, and Leyte. An ample right shell-lobe (fig. 6 *b*) extends over the right margin of the shell. With such a specimen little else could be described.

The jaw (fig. 7) is much arched above, and very convex on the cutting-edge.

The lingual ribbon (figs. 8, 8 *a*) is very broad, the teeth arranged thus

130 . 4 . 6 . 1 . 6 . 4. 130
140 . 1 . 140.
In over 85 rows.

The central tooth (fig. 8) is long pointed, with two side cusps about the middle; the side teeth are broad, with cusp on the outer margin, followed by narrow curved bicuspid laterals; while the outermost of all (fig. 8 *b*) are pectiniform, similar to what we find in typical *Durgella*.

This is another of the many fine species collected in the islands of the Malay Archipelago by Mr. W. Doherty. We cannot too strongly admire his labour, and thank him and congratulate him on the good work he performed. I can only regret and say how sorry I am that the publication of results has been so unavoidably slow.

The interest attaching to this species is very great, and for this reason I introduce it here among the Indian fauna. We have presented to us a form directly intermediate between the genus under review and *Cryptosoma*, as shown in the odontophore. For whereas in *Durgella* all the teeth from the centre outward are very numerous, all alike, and pectiniform, we have here a radula of similar breadth, with a broad central band of large broad teeth like those of *Macrochlamys* and its allies, succeeded by teeth such as *Cryptosoma* presents, and followed by others with pectinated edges. The very long horn-like process at the extremity of the foot is a marked specific character.

Great interest now centres on the generative organs when they shall come to be examined, as to whether they are of the type of *Parmarion*, *Microparmarion*, &c., or of *Durgella* or *Macrochlamys*. I now place it with a query in *Durgella*, but it may ultimately have to be placed in a new subgenus of its own, but to do so without further material would be altogether premature.

Durgella dekhanensis, n. sp. (Plate LXXVIII. figs. 1–5.)

*Locality.* South India (*Colonel R. Beddome*).

Shell very thin, horny, membranaceous, depressedly conoid; sculpture none; colour rich sienna-brown; spire low; apex flat; suture shallow; whorls 4; aperture widely ovate; peristome very thin; columellar margin scarcely thickened, and a very little reflected.

Size: maj. diam. 18·5, min. 16·0; alt. axis 8·0 mm.

Specimens vary much in size, and, as is usual, also in their coloration.

*Animal* (figs. 2, 2 *a*) with a narrow foot, sharply keeled behind, a very pointed extremity overhanging the narrow linear mucous gland (fig. 2 *b*). The shell-lobes (fig. 2 *d*) on right and left side are very ample, and must in life almost cover the entire shell; they are smooth and much paler than the rest of the animal. The neck-lobes are also large and pale in colour. The shell-lobe is not continuous round the posterior side of the shell, above the keel of the foot, as in *Cryptosoma*, but the neck-lobe only is continuous in a narrow fillet or girdle. The coloration differs from (*a*) an indigo-grey throughout to paler grey, pale ruddy on keel of foot to the overhanging lobe; (*b*) pale throughout, with only a dusky tint along the pallial margin; (*c*) pale ruddy ochre, with a darkish oblique line on each side of the foot, shaded off above—which may be called var. *bicolor* (fig. 3). Sole of foot (fig. 2 *c*) divided into three equal parts, the margins well segmented up to the longitudinal limiting line. Jaw (fig. 4) thin, soft and horny, nearly straight in front. Teeth of radula multitudinous, very minute, bicuspid.

*Generative organs* (fig. 5). The amatorial organ is absent. The penis is a strong plain cylindrical and long muscular sheath, with a very strong retractor muscle, given off where the vas deferens joins; this last is a wide tube near the junction, rapidly diminishing to a uniform size. The spermatheca rises on a short stem and swells out suddenly into a moderately long, blunt sac.

Durgella levidensis, n. sp. (Plate LXXVIII. figs. 6–9.)

Tinevelly Hills, Travancore (*Colonel R. Beddome*).

Shell globose; sculpture none; colour pale green and ochraceous spire small, flatly conic; apex blunt; suture very shallow.

Size: maj. diam. 10·5; alt. axis 5·5 mm. Length of animal spirit 13·5 mm.

Its much higher spire, globose form, and smaller size separate from *D. dekhanensis*.

The animal (fig. 6) is the same in every respect as the preceding species; the shell-lobes are very ample. The male organ (fig. 7) is rather short and bulbous; on opening it down the side (fig. 7 *a*) it was found to terminate in a round bud-like nipple—one side higher than the other (fig. 7 *b*). The buccal mass is large and broad, square at the back, with a leathery jaw, quadrate in shape, straight-edged. The lingual ribbon is like that of *D. dekhanensis*. The

central tooth is small, consisting of one simple point; the median teeth (figs. 7, 8) are long, uniform, and evenly bicuspid; the outermost become serrated on the side below the bicuspid apex. The whole are very closely packed together, and I found it impossible to count the number in a row with any certainty.

$$+350 \ . \ 1 \ . \ 350 \text{ to } 400$$

68 rows are shown on a radula whose breadth equals its length.

I am indebted to Colonel R. Beddome, who has added so many species of land-shells to the Indian list, for very kindly letting me have these shells to describe and figure; and I wish I could have published them before now, but I thought it best not to do so until they could be included with other species of the same genus. They are of extreme interest as being the first species that can be included in the subfamily Durgellinæ from Southern India. They, however, differ from typical *Durgella* to this extent:—

1. In having no amatorial organ.
2. In the longer overhanging lobe above the mucous gland.
3. In the teeth of the radula being all bicuspid in the centre.

The nearest species to them is *D. christianæ* of the Andaman Islands.

In 1891, when describing in the P. Z. S. a large series of Bornean shells collected by Mr. A. Everett, I placed in *Durgella*, p. 40, a species named *hosei*, on the form of its shell-lobes and odontophore, which last I give on Plate LXXIX. The radula (fig. 9) is very similar to that of *D. minuta*, G.-A., of the Dafla Hills, described in Vol. I. Pt. IV. p. 144, Plate XXXIX. figs. 1–6. The generative organs were not seen.

The genus now contains 9 species, which may be located in the following groups:—

Radula with very great number of teeth in the row, and of small size, the breadth very large in proportion to the length. Jaw straight, weak.

| | | |
|---|---|---|
| A. *With an amatorial organ.* | | |
| *a.* All the teeth in row serrate | *levicula*, Bs. | Tenasserim. |
| | *mairangensis*, G.-A. | Khasi Hills. |
| *a'.* Teeth not serrate, central unicuspid | *minuta*, G.-A. | Khasi Hills. |
| | *hosei*, G.-A. | Borneo. |
| *a''.* Teeth not serrate, central tricuspid | *khasiaca*, G.-A. | Khasi Hills. |
| B. *Without an amatorial organ.* | | |
| *b.* All the teeth serrate | *assamica*, G.-A. | Assam. |
| *b'.* Centrals bicuspid, marginal serrate | *christianæ*, Theob. | Andamans. |
| | *dekhanensis*, G.-A. | Southern India. |
| | *levidensis*, G.-A. | Southern India. |
| C. *Amatorial organ with calcareous dart.* | | |
| *c.* Teeth not serrate, central tricuspid | *Damayantia smithi* | Borneo. |
| D. *Amatorial organ ?* | | |
| *d.* Central teeth large, as in *Macrochlamys*, marginal serrate. | *D. ? sumbaensis* | Sumba Island. |

On Plate LXXIX. fig. 10 I give a drawing of malformation in the overhanging lobe at the extremity of the foot of a specimen of

*Durgella dekhanensis*, where a second lobe had grown out above the normal one. Although I have now examined many hundreds of these animals, it is the first case that has come before me. Accidental variation of this nature is now and then presented in the radula, where one of the teeth will show a decided and unusual outline, which, commencing in its embryonic development, is repeated in every succeeding tooth.

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The foundation on which investigation of the anatomy of the Indian land-mollusca rests will always be the laborious work of Semper; yet, as is usual with work of this kind, all the requisite material not being at hand, it could never be completed by him. Thus we find that Semper in 1870 described the anatomy of a few shells from Peninsular India, but nothing has been done since. I have been fortunate of late in obtaining some material from Bombay and Madras, which I hope will enable me to advance the classification of our Indian land-shells. I have to thank Mr. Phipson, of Bombay, and Dr. Thurston, of Madras, for the shells they collected for me in spirits; and I must not forget similar assistance afforded by Mr. W. T. Blanford and Colonel R. Beddome out of their collections. I propose to treat first of the genus *Hemiplecta*, which Semper did not recognize, and then some species of the genus *Xesta*, a genus in which he included a number of species having a wide range and many different characters.

## Family ZONITIDÆ.

### Genus Hemiplecta.

J. C. Albers, Die Heliceen, p. 60 (1850).

J. C. Albers, from his MSS. Die Heliceen, 2nd edit. by Ed. von Martens, p. 52 (1861).

H. & A. Adams, Gen. of Recent Mollusca, p. 222 (1858).

W. Theobald, Suppl. Cat. Land & Freshwater Shells of Brit. India, pp. 4, 5, & 21 (1876).

G. Nevill, Hand-list of Mollusca in the Indian Museum, Calcutta, p. 46 (1878).

H. H. Godwin-Austen, Jour. Asiat. Soc. Bengal, p. 155 (1880).

L. Pfeiffer, posthumous edit. S. Clessin, Nomenclator Heliceorum viventium, p. 48 (1881).

Geo. Tryon, Jr., Manual of Conchology, Zonitidæ, p. 35 (1886).

In the 'Journal of the Asiatic Society of Bengal,' 1880, p. 155, in a paper on drawings of the animals of various genera left to us by Ferd. Stoliczka, I gave a list of the species placed in the genus *Hemiplecta* by different conchologists, but based only on shell-

characters. The greater number recorded are from the islands of the Malay Archipelago, which, being beyond the limits of my work, I shall not at present refer to, confining myself in the following lists to those found within the Indian area and the Malay Peninsula down to Penang and Singapur.

In the first list, by Albers, the only Indian species is *labiata*, Pfr., from the N.W. Himalaya, which in the 2nd edition by Ed. von Martens is transferred to *Xesta*; at the same time, five other Indian species are included in *Hemiplecta*, viz.:—*H. cycloplax* and *H. orobia*, which I have shown in Part IV. pp. 125 & 129, belong to *Oxytes*; there is *theodori*, Phil., from Mergui, which is probably a *Macrochlamys*, from its resemblance in form to *M. decussata*; lastly, *H. gardneri*, Pfr., and *chenui*, Pfr., from Ceylon, both of which I have no doubt are quite distinct from the type of the genus and its allies inhabiting the Malay Peninsula and the great islands. Adams placed in it *ligulata*, *semirugata*, and *tranquebarica*. Nevill restricted it entirely to the Indian, Burmese, and Malay Peninsula areas, including in it only 16 species. Theobald adopted this generic title for a large number of species (34), with forms so varied that he had to subdivide it into 5 sections, noting the typical species in each. Still later, Clessin, editing L. Pfeiffer's work, raises the total number of species under this genus to 104, 35 being Indian, dividing them into 3 groups after the form of the shell; the species are of the most varied character and must represent several distinct genera. This shows how arbitrary has been the classification of the Indian Pulmonifera, and the necessity for generic appellations to be dependent on something more than one external character. W. T. Blanford, J. A. S. B. 1880, pp. 187, 188, has added two species to the genus in *H. triostoma* and *enisa*, both from Travancore.

On pp. 72–73 is a list of all the Indian species that have been placed in this genus by different authors, showing the genera to which they have been since transferred or may more accurately be placed in, those still doubtful being indicated by a query.

Tryon includes a large number of species from the Malay Archipelago &c. in this genus. It is a useful genus for many distinct and distantly related animals. On turning to his plates, several species in the text under *Hemiplecta* are found under *Rhysota*, so that it is somewhat doubtful how to accept their position. There is a wide field of work here waiting to be done.

Owing to the courtesy of Messrs. Little & Co., of Singapur, to whom I wrote for specimens in spirit of Albers's type species, *Helix humphreysiana*, I am now enabled to describe the animal and give the genus a defined position among these Indian forms. I may say at once that, taking all the characters combined, there is no form I have yet seen from India like it. In the mantle there is some similarity with *Macrochlamys*; in the odontophore more with *Ariophanta* and *Oxytes*, yet sufficiently defined to be most distinctive.

## Hemiplecta.

| Genus in which they should stand. | Name. | Locality. | Albers and von Martens. | Adams. | Theobald. | Nevill. | Pfeiffer *. | Tryon. |
|---|---|---|---|---|---|---|---|---|
| *Bensonia* | *labiata*, Pfr. = *monticola*, Bs. | N.W. Himalaya. | 1850. | ... | Sec. C. | | | |
| *Hemiplecta* (type) | *humphreysiana* | Singapur. | 1861. | ... | ...... | 1878. | | |
| *Oxytes*, G.-A., Pt. IV. | *cycloplax* | Darjiling. | 1861. | ... | 1876, Sec. D. | 1878. | Sec. C. | |
| Do., do. | *orobia* | ,, | 1861. | ... | Sec. C. | 1878. | | |
| *Macrochlamys* ? | *theodori* | Mergui. | 1861. | ... | ...... | ... | Sec. A. | |
| *Euplecta* | *gardneri* = *albizonata*, Dohrn | Ceylon. | 1861. | ... | ...... | ... | ,, | |
| ? | *chenui* | ,, | 1861. | ... | ...... | 1878. | Sec. B. | |
| *Nilgiria* ? | *ligulata* † | Bengal and Madras. | ... | 1858. | Sec. A. | | | |
| Do. ? | *semirugata* | Bengal. | ... | 1858. | ,, | | | |
| Do. | *tranquebarica* | E. coast India. | ... | 1858. | ,, | ... | 1881, Sec. A. | |
| Do. ? | *belangeri* | S. India. | ... | ... | ,, | | | |
| ? | *biciliata* | Ceylon. | ... | ... | ,, | | | |
| Do. ? | *bombayana* | Bombay. | ... | ... | ,, | | | |
| Do. | *maderaspatana* | Nilghiris. | ... | ... | ,, | | | |
| Do. ? | *vitellina* | ,, | ... | ... | ,, | | | |
| *Hemiplecta* ? | *undosa* | Shan States. | ... | ... | ,, | 1878. | Sec. A. | 1886. |
| *Nilgiria* ? | *sisparica* | Nilghiri Hills, Madr. | ... | ... | ,, | ... | ...... | 1886. |
| Do. | *bistrialis* | E. coast India. | ... | ... | Sec. B. | ... | Sec. A. | |
| Do. | *ceylanica*, Pfr. | Ceylon. | | | | | | |
| Do. | var. *taprobanensis*, Dohrn | ,, | | | | | | |
| Do. ? | *cyix* | ,, | ... | ... | ,, | ... | Sec. B. | |
| Do. ? | *carneola* | ,, | ... | ... | Sec. C. | | | |
| Do. ? | *juliana* | ,, | ... | ... | ,, | | | |
| Do. ? | *perfucata* | ,, | ... | ... | ,, | | | |
| Do. | *solata* | Nilghiris. | ... | ... | ,, | | | |
| ? | *basilessa* | Travancore. | ... | ... | Sec. D. | 1878. | | |
| *Oxytes*, G.-A., Pt. IV. | *blanfordi* | Darjiling. | ... | ... | ,, | ... | Sec. C. | |
| Do., do. | *castor* | Khasi Hills. | ... | ... | ,, | 1878. | ,, | |
| Do., do. | ——, var. *cherraensis* | ,, | ... | ... | ,, | ... | ,, | |
| Do. (type) | *oxytes* | ,, | ... | ... | ,, | 1878. | | |
| Do. | *pollux* | ,, | ... | ... | ,, | 1878. | Sec. C. | |
| ? | *basileus* | Annamully. | ... | ... | Sec. E. | 1878. | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ? | *beddomei* | Travancore. | ... | ... | Sec. E. | 1878. | ...... | 1886. |
| *Euplecta* ‡ | *convexiuscula* | Ceylon. | ... | ... | ″ | | | |
| ? | *ganoma* | ″ | ... | ... | 1876, Sec. E. | | | |
| *Nilgiria*? | *isabellina* | ″ | ... | ... | Sec. E. | ... | Sec. C. | 1886. |
| *Ariophanta*?, G.-A. | *retrorsa* | Tenasserim. | ... | ... | ″ | | | |
| *Hemiplecta*? | *saturnia* | ″ | ... | ... | ″ | | | |
| ? | *travancorica* | Madras. | ... | ... | ″ | ... | Sec. C. | 1886. |
| *Hemiplecta* | *uter* | Moulmain. | ... | ... | ″ | | | |
| Do., G.-A. | *cymatium* | Penang. | ... | ... | ... | 1878. | ...... | 1886. |
| ? | *textrina* | Burmah. | ... | ... | ... | ... | Sec. A. | |
| *Nilgiria*? | *taprobanensis* | Ceylon. | ... | ... | ... | ... | ″ | |
| Do.? | *rosamonda* | ″ | ... | ... | ... | ... | Sec. B. | 1886. |
| Do.? | *hebescens* | Annamullys. | ... | ... | ... | ... | ″ | |
| *Durgella*? | *lixa* | South India. | ... | ... | ... | ... | ″ | |
| ? | *falcata* | Khasi. | ... | ... | ... | ... | ″ | |
| *Nilgiria*? | *subdecussata* | Bombay. | ... | ... | ... | ... | ″ | |
| Do.? | *sisparica* | Nilghiris. | ... | ... | ... | ... | ″ | |
| ? | *shisha* | Khasi. | ... | ... | ... | ... | Sec. C. | |
| ? | *albizonata* | Ceylon. | ... | ... | ... | ... | ″ | |
| ? | *læta* | Annamullys. | ... | ... | ... | ... | ″ | |
| ? | *haughtoni* | Andamans. | ... | ... | ... | ... | ″ | 1886. |
| ? | *semidecussata* | Ceylon. | ... | ... | ... | ... | ″ | 1886. |
| ? | *shiplayi* | Nilghiris. | ... | ... | ... | ... | ″ | |
| *Euplecta*? ‡ | *emiliana* = *singalensis* | Ceylon. | ... | ... | ... | ... | ″ | |
| Do.? ‡ | *hyphasma* | ″ | ... | ... | ... | ... | ″ | |
| ? | *acuducta* | Nilghiris. | ... | ... | ... | ... | ″ | 1886. |
| ? | *ceraria* | Ceylon. | ... | .. | ... | ... | ″ | 1886. |
| *Machrochlamys*? | *camura* | Darjiling. | ... | ... | ... | ... | ″ | |
| *Nilgiria*? | *koondaensis* | South India. | ... | ... | ... | ... | ″ | |
| ? | *gordoniæ* | Moulmain. | ... | ... | ... | ... | ″ | |
| *Nilgiria*? | *tinostoma* | Travancore. | ... | ... | ... | ... | ... | 1886. |
| Do.? | *enisa*, Blf., 1880 | ″ | ... | ... | ... | ... | ... | 1886. |
| Do.? | *indica*, Pfr. | Nilghiris. | | | | | | |

* Sec. A = Ecarinate. Sec. B = Subangulate. Sec. C = Carinate.
† Type of genus *Cryptosoma* of Mörch, Journ. de Conch. p. 334 (1872).
‡ *Vide* Proc. Malacol. Soc. vol. ii. pt. 4, p. 176 (1897).

Hemiplecta humphreysiana, Lea. (Plate LXXX. figs. 6–6 *b* and Plate LXXXI. figs. 1–1 *e*.)

*Helix humphreysiana*, I. Lea, Trans. Amer. Phil. Soc. vol. vii. p. 463 (1841) (read February 21st, 1841), pl. xii. fig. 16.

*Helix humphreysiana*, Chemn. ed. ii. *Helix*, no. 168, t. xxxi. f. 3 & 4 ; Fér. Hist. livr. xxxiv. t. 2. f. 7 ; Pfr. vol. i. p. 43 : "Var. β, *pallide lutea, absque fascia, basi fulvescens* (Mus. Cuming)."

*Hemiplecta humphreysiana*, Albers, Die Heliceen, 1850, p. 60 (a list of 20 species given, but types not defined) ; id. 2nd ed. by Ed. von Martens, 1861, p. 52, made the type.

*Nanina* (*Hemiplecta*) *humphreysiana*, Nevill, Hand-list, p. 46 (4 sp. from Singapur); Clessin, Nomen. Helic. vivent. Pfr. pp. 48, 49.

*Nanina humphreysiana*, var. *complanata*, from Singapur, von Martens, Preuss. Exped. Ost-Asien, t. 10. f. 2 (1867).

*Nanina humphreysiana*, var. *bifasciata*, von Martens, Preuss. Exped. Ost-Asien, t. 10. f. 4 (1867).

*Nanina humphreysiana*, Wallace, P. Z. S. 1865, p. 406.

Original description :—"*Testa orbiculato-conoidea, subtus convexa, minute rugosa, albido-fulva, ad peripheriam fasciata, late umbilicata, profunde perforata ; anfractibus senis, convexis ; apertura submagna, obliqua ; labro acuto ; columella lævi.*

"Shell orbicular-conical, convex beneath, minutely wrinkled, tawny, banded on the periphery, widely umbilicate, deeply perforate ; whorls six, convex ; aperture rather large, oblique ; lip acute ; columella smooth.

"*Hab.* Pondicherry (*S. Humphreys*) ; Singapur (*J. Balestier*).

"My cabinet. Diam. 1·9.

"*Remarks.* About a year since, Mr. Humphreys kindly presented me with several specimens of this shell ; and subsequently I have received two or three from Mr. Balestier, of Singapur. In general outline it resembles *H. unidentata*, Lam. Its spire is elevated. Some individuals have an indistinct band over the dark one of the periphery."

We may dismiss the Pondicherry habitat with the above original description and figure of the shell, for nothing approaching it is found in Madras. Fortunately the true habitat—Singapur—can be fixed upon without doubt of any sort. In the old days, and even up to very recently, geographical distribution was of no consideration, and the place from which a collection was despatched was sufficient for the describer to indicate.

*Description.* The animal (Plate LXXX. figs. 6, 6 *a*) has the foot divided below, pallial line distinct : the surface above on the sides apparently rather rough or warty. The mucous pore, from the very puckered state in the spirit-specimens, is wide and large in the living animal, with an overhanging lobe. The right shell-lobe (fig. 6) is short and triangular in shape ; the left shell-lobe (fig. 6 *a*) is narrow and ribbon-like, giving off a tongue-shaped process just above the commencement of the posterior portion of the left

dorsal lobe. The right dorsal lobe (fig. 6) is of the ordinary form and ample, the left (fig. 6 *a*) in two very distinct portions; the posterior does not extend far back.

The jaw (Plate LXXXI. fig. 1 *e*) has no central projection on the cutting-edge.

The radula (figs. 1–1 *d*) is very long and very broad, 8·5 × 4 mm., there being a greater number of large central teeth than usual. They are straight-sided teeth, elongately triangular in form, all of equal size, two intermediate of less breadth, succeeded by long narrow curved unicuspid teeth. At about the 70th tooth from the central one a slight notch becomes apparent near the apex, which soon develops in the marginal teeth into the bicuspid form, and about twenty of the outermost are very small. The arrangement of the teeth is:—

125 . 2 . 20 . 1 . 20 . 2 . 125
147 . 1 . 147
295 in the row.

I counted 163 rows, or some 48,000 teeth.

*Generative organs* (Plate LXXX. fig. 6 *b*). The retractor muscle of the penis is situated at about three fourths of the total length of the long tube-like sheath from the generative aperture up to the terminal bulbous point where the vas deferens is given off; there is thus no free kalk-sac, as in *Macrochlamys* and *Oxytes*. The amatorial organ is very large, solid, and cylindrical, with a retractor muscle. The spermatophore is pear-shaped and short. The oviduct, albumen-gland, &c. present no characteristic features.

It may be noticed that the form of the mantle-lobes is somewhat like those in *Macrochlamys*, but there the resemblance ends; the radula differs completely both in the number and form of the teeth, being, as regards the larger straight laterals, like those of *Oxytes*. The generative organs of *Hemiplecta* differ from both. Of all the species that have hitherto been described in full, it agrees in a most interesting and complete way with *Rhysota cymatium* from Penang. This is described by Stoliczka in a paper on the shells of that place, J. A. S. B. 1873, p. 11; the right and left shell-lobes are present, and we find the same large number of teeth in each row; the only difference noticeable is the small size of the central tooth in *cymatium*. These characters remove it from *Rhysota*, which Semper clearly points out has (1) no shell-lobes to the mantle, and (2) the simple form of the genital organs, the amatorial organ being absent in all the species he describes. I do not myself place much value on the polished lower surface of the shell as a generic character. Shell-lobes have no invariable connection with a polished glassy surface, for in many species of true *Macrochlamys* possessing very lengthened shell-lobes they play over a rough decussated shell-surface—notably *M. decussata* of the Khasi Hills. *Rhysota cymatium* must be transferred to *Hemiplecta*. So also must *densa* (Plate LXXXI. figs. 2–2 *c*). My description of the animal of this fine species from Borneo, published in the P. Z. S. Jan. 6, 1891,

may be useful here, to show how very near it is to the Singapur shell in all its characters, and as a proof of the range eastward of the genus *Hemiplecta*:—"*Animal.* The extremity of the foot is rather square, the mucous gland large, not extending to the sole of the foot, and with apparently no overhanging lobe. The right dorsal lobe is of usual size, but the left is very poorly developed, being very narrow and separated into two parts, the posterior portion being narrow and only 6 millim. long; in the space between them lies a small left shell-lobe, flat and tongue-shaped; a right shell-lobe is also present, which would appear in life to be broad and triangular in outline.

"The odontophore [figs. 2–2 *b*] is like that of *H. humphreysiana* from Singapur, the type of the genus *Hemiplecta*. Jaw circular, no central projection [fig. 2 *c*].

"The shells had been taken evidently in the cold season, and the generative organs were not fully developed in the specimens I dissected, but enough was seen to show the presence of a long simple amatorial organ, and the male organ also, as in *Hemiplecta*."

Semper has placed five South-Indian shells * (included in the above list of *Hemiplecta* of different authors) in the genus *Xesta*. *Hemiplecta*, as I said before, he does not recognize; and he splits *Xesta* up into 3 sections, not indicated by subgeneric titles. These sections have, I think, too many differences *inter se* to be retained in the same genus. His first group is entirely confined to the South Indian Peninsular area, possesses no shell-lobes, and has tricuspid central teeth and bicuspid or aculeate laterals, few in number in the row. The second group is represented by one species—*cumingi*, of Mindanao—very distinct, with large expanded mantle-lobes, as in the *Helicarion* division. The third is the Malayan group, with tongue-shaped shell-lobes and neck-lobe (dorsal lobe) in two lappets, containing the very distinct and a typical species of Albers's genus *Xesta*, viz. *citrina*, together with *distincta* and *mindanensis*. The first group must be now considered quite distinct, as I shall show and refer to it further on; the second must be placed elsewhere; and the third remains as Semper put it, and forms a very characteristic genus of the islands of the Malay Archipelago. It is fortunate that Albers, in his original description of *Xesta* ('Die Heliceen,' 1850, p. 58), places *citrina* at the head of the list of species; otherwise there might have been a doubt as to whether *citrina* or *stuartiæ* was the typical shell. There are certain resemblances, as might be expected, between *Hemiplecta humphreysiana* and *Xesta citrina* and *X. distincta* which bring these two subgenera near each other, particularly in the odontophore: both have 350 and 300 teeth respectively in the row, and of the same simple straight form as regards the central teeth; but the very long thread-like *bursa seminalis* with globular end in *X. citrina* is a marked difference in the generative organs.

* *Ligulata, tranquebarica, maderaspatana, belangeri, bistrialis.*

Hemiplecta uter, Theobald. (Plate LXXXII. figs. 1–1 *d.*)

*Helix uter*, Theob. J. A. S. B. 1859, p. 309 (from Moulmain); Pfr. Mon. Hel. vol. v. p. 127; Hanley, Conch. Ind. p. 27, pl. lviii. figs. 7, 8.

*Hemiplecta* (sec. E) *uter*, Theob. Supp. Cat. p. 22 (Moulmain and hills west of Tonghu).

*Locality.* Mulé-it Range, Tenasserim (*O. Limborg*).

With a very small lobe over the mucous pore. A short right shell-lobe, as well as a short narrow left shell-lobe. The left neck-lobe in two separate parts.

The odontophore (figs. 1 *a*–1 *d*) is, as regards the type of teeth, like that of *Hemiplecta humphreysiana*; the centrals being straight-sided, triangular, simple, succeeded by curved unicuspid teeth passing to outer smaller teeth of bicuspid form, arranged thus:—

77 . 38 . 10 . 1 . 10 . 38 . 77
125 . 1 . 125

The jaw (fig. 1) has no central projection, thus again like the above-named type form.

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To return to Semper's First Group, or the Indian species he placed in *Xesta*, I have long considered it necessary to place them in a new genus, of which I take as the type species *Helix solata*, Benson, from the Nilgiri Hills, on the slopes of which range and at their base many similar forms occur, some of which may be expected to range further south to Ceylon.

## Genus Nilgiria. (Plates LXXX.–LXXXII.)

[Indicated in Vol. I. Part VI. p. 253 (1888).]

*Animal.* The mantle-edge long and narrow, following the peristome; no shell-lobes. Right dorsal lobe small; left dorsal lobe long, narrow, and continuous. Sole of foot not divided. Opening of mucous pore extends to the sole of the foot; overhung by a blunt process. Amatorial organ large; retractor muscle of male organ attached to a long diverticulum. Spermatheca short.

Nilgiria solata, Bs. (Plate LXXX. figs. 1–4 *a.*)

*Helix solata*, Benson, A. M. N. H. 1848, vol. ii. p. 159; Pfr. Mon. Hel. vol. iii. p. 67, vol. iv. p. 170; Reeve, Conch. Icon., *Helix*, fig. 741.

*Helix menkiana*, Reeve, Conch. Icon., *Helix*, no. 591, t. 106.

*Helix menkiana*, var., Chemn. ed. nov., *Helix*, t. 133. figs. 3–4.

*Nanina solata*, Gray, Cat. Pulm. p. 84.

*Nanina* (*Rhysota*) *solata*, Pfr. Vers. p. 121.

*Hemiplecta? solata*, W. T. Blf., A. M. N. H. Feb. 1863.

*Helix solata*, Hanley, Conch. Ind. p. 14, pl. xxviii. fig. 6 (this only gives the shell viewed from the back).

*Hemiplecta solata* (sec. C), Theob. Supp. Cat. p. 22.

*Nanina* (*Xesta*) *solata*, Nevill, Hand-list, p. 50.

*Nanina* (*Xesta*) (Group *a*) *solata*, Albers, Die Heliceen, 2nd ed. by Ed. von Martens, 1861, p. 51.

*Xesta solata*, Pfr. Nomen. Helic. vivent. ed. Clessin, p. 41.

*Locality*. South India (*Beddome*).

Original description:—"*Testa perforata, depresso-globosa, radiato-striata, nitida, cærulescente-albida, antice rufescente, versus apicem rufo-castanea, punctis plurimis brunneis translucentibus quasi solata, fascia unica castanea supra angulum anfractus ultimi usque ad apicem decurrente,* 1–3 *obsoletis subtus ornata; anfractibus* 5, *convexiusculis, ultimo subangulato, angulo antice evanescente; spira obtusata; apertura obliqua, transverse ovato-lunata, perihemate intus fusco-castaneo, albo-marginato; labro recto, deflexo, margine columellari subreflexo, umbilicum fere tegente.*

"Diam. major 23, minor 18; axis 11 mill.

"*Hab.* montibus Nilgherries Indiæ meridionalis (*Dr. Jerdon*).

"I owe this species to the kindness of Dr. Jerdon, who sent it to me with other interesting shells from the Madras Presidency. He found it on the western face of the Nilgherries. I have a larger specimen from the same source in bad condition."

*Animal* (Plate LXXX. figs. 2 & 2 *a*). There are no shell-lobes to the mantle; the right dorsal lobe is small, the left long, narrow, and continuous. Sole of foot not divided (fig. 2 *a*), but puckered and wrinkled transversely. The mucous pore is overhung by a slight blunt process (fig. 3), and the slit extends to the sole of the foot. Pallial line distinct, above a broad peripodial margin. In the generative organs (fig. 4) the amatorial is solid and cylindrical, with a retractor muscle; in the male organ there is a stout and long cæcum-like process, at the head of which the retractor muscle is given off. The spermatophore is short and pear-shaped. The teeth of the radula (Plate LXXXII. figs. 2–2 *c*) are arranged:

$$\begin{array}{c} 35 \,.\, 2 \,.\, 15 \,.\, 1 \,.\, 15 \,.\, 2 \,.\, 35 \\ 52 \,.\, 1 \,.\, 52 \end{array}$$

The central tooth is strongly tricuspid, the adjacent central teeth are hardly tricuspid, only showing an exceedingly fine notch on some of the teeth on the inner upper margin; the laterals do not decrease much in size towards the margin, and are evenly bicuspid—in fact, very similar to the *Macrochlamys* form of the radula. The dentition of *N. solata* is also similar in character to that as figured by Semper of *Xesta belangeri, tranquebarica, maderaspatana*, and *ligulata*.

Nilgiria tranquebarica, Fabricius, MS. (Plate LXXXI. figs. 3–3 *d*.)

*Galaxias tranquebarica*, in Beck's Index, 1837 (name only), p. 42; Mon. Helic. vol. i. p. 41.

*Helix tranquebarica*, Reeve, Conch. Icon. fig. 394; Conch. Ind. p. 27, pl. lix. fig. 3.

*Hemiplecta? tranquebarica*, W. T. Blanford, A. M. N. Hist. Feb. 1863.

*Hemiplecta*, sec. A, Theob. Cat. L. & Freshw. Moll. Ind. p. 22.

*Nanina (Xesta? Acusta?) tranquebarica*, Nevill, Hand-list, 1878, p. 51.

*Hemiplecta*, in nomencl., Pfr. Mon. Helic. 1848.

*Xesta tranquebarica*, Semper, Reis. Philippinen, Land Moll. iii. 1870, p. 65, pl. iii. fig. 26, pl. v. figs. 13–23, pl. vii. fig. 10.

Description (in Pfeiffer):—"*T. anguste umbilicata, globosa, crassa, distincte striata, lineis obsoletis superne decussata, albida; spira elevata; anf.* 5½, *convexiusculi, ultimus antice descendens; apertura lineato-ovalis, intus lactea; perist. subincrassatum; marginibus convergentibus, columellari calloso, reflexo, umbilicum non tegente.*

"Diam. maj. 24, min. 17; alt. 15 mill. (Mus. Cuming).

"Habitat in Tranquebar."

*Animal.* No shell-lobes (Pl. LXXXI. fig. 3); a triangular-shaped right dorsal lobe and a long narrow left dorsal lobe; foot not divided.

*Generative organs* (figs. 3*a* & 3*b*). The retractor muscle of the male organ is given off from an extremely long diverticulum, the "*cæcum musculi retractoris penis*" of Semper. Where the vas deferens joins the sheath there is a well-developed kalk-sac; this, with a portion which follows, is nearly equal in length to the diverticulum above mentioned. From where this is given off the sheath is a long and narrow tube, found rolled together (as in fig. 3 *b*); when separated out it is irregular in diameter and still convolute. The spermatheca is bulbous on a short narrow neck. The amatorial organ is very massive and thickened towards the posterior end; in the centre is a long, hard, cylindrical rod, rounded at the posterior end, with a rather blunt point at the anterior. Below the ovo-testis there is a sort of kink in the vaginal tube.

In one specimen dissected I was fortunate to secure in most perfect preservation three spermatophores, of one of which I give a drawing (figs. 3 *c*, 3 *d*). It consists of a long narrow bag (9 mm. in length), tapering to a fine tube. This bag is attached to a hard, chitinous, curved sort of gutter, set on one side with the usual spines. These, however, are characteristic, being arranged in bunches at regular intervals, and are not unlike the head of a many-tined fish-spear; they consist of four equal sharp spikes, rising from a single short stalk, flower-like in form, and about 10 were counted. In this character it differs from the spermatophore of other genera with which I am acquainted.

Jaw (Pl. LXXXII. fig. 3) arched above, with a central projection.

The radula (figs. 3*a*–3 *c*) agrees on the whole with that of *N. solata*, but the median teeth are tricuspid, the inner cusp higher than the outer, while the outermost teeth are longer and not evenly bicuspid. Nos. 17, 18, and 19 differ in no respect. The formula is—

54 . 3 . 17 . 1 . 17 . 3 . 54
74 . 1 . 74

NILGIRIA BISTRIALIS, Beck. (Plate LXXXI. figs. 4, 4 *a*.)

*Nanina bistrialis*, Beck, Index Moll. p. 2 (no description); Pfr. Mon. Helic. vol. i. p. 71: as *diaphana*, Lea, and *exilis*, Chemn. ix. 1831.

*Helix bistrialis*, Reeve, Conch. Icon. fig. 483; Conch. Ind. p. 14, pl. xxix. fig. 1.

*Hemiplecta* (sec. C) *bistrialis*, Theobald, Cat. L. & Freshw. Moll. Ind. p. 22.

*Hemiplecta ? bistrialis*, Blanford, A. M. N. H. Feb. 1863.

*Xestina*, Pfr. Jahrb. v. p. 257 (1878): type *X. siamensis*, Pfr.

*Xesta bistrialis*, Semper, Reis. Philipp. p. 64, pl. iii. fig. 15, pl. vi. fig. 25 (1870).

*Nanina* (*Xesta* ?) *bistrialis*, Nev. Hand-list, 1878, p. 51.

In Mr. W. T. Blanford's collection (No. 47. 1) there is one specimen from Ceylon.

Original description :—" *T. subperforata, globoso-depressa, tenuis, fragilis, subtilissime striata, striis confertis obsoletis sub lente decussata, stramineo-cornea, lineis 2 rufis approximatis medio cincta; spira vix convexa; anfr.* 4, *planiusculi, rapide crescentes; apertura ampla, lunari-ovalis; perist. simplex, margine columellari recurvato.*

" Diam. maj. 34, min. 25; alt. 15 mill.

" Habitat prope Pondicherry; Tranquebar."

*Locality*. Madras (*Dr. Thurston*).

The mantle margin is quite plain; no shell-lobes; the neck-lobes are as in *N. tranquebarica* (fig. 3).

The jaw (Pl. LXXXII. fig. 5) is slightly arched, with a flatly-curved central projection. The central teeth (fig. 5 *a*) are all tricuspid and on broad plates, narrowing at the 18th and 19th–20th (fig. 5 *b*), losing the side cusps gradually and becoming stoutly aculeate, and the laterals are long and aculeate, becoming very minute on the outer edges (fig. 5 *d*). They are arranged thus—

50 . 2 . 17 . 1 . 17 . 2 . 50
69 . 1 . 69

The genitalia (fig. 4) compare well with those of *solata* and *tranquebarica*. The diverticulum of the male organ is not so long as in the latter. The spermatheca is a globular sac on a short broad stem. The amatorial organ is very elongate and twisted, the sharp turn near the basal point being nearly at right angles to the succeeding portion. It has a central muscular hard rod, terminating in a fine point (fig. 4 *a*), covered successively externally by close-fitting cases, through which the point is extensible. Strong retractor muscles are seen near the base, and another at the extreme or posterior end.

The acquisition and dissection of *tranquebarica* and *bistrialis* have shown that both these species must be also included in *Nilgiria*, for in nearly all principal characters they agree with those of *N. solata*, with the exception of the aculeate teeth of radula in *bistrialis*.

Proceeding further in a review of these molluscs, it is of considerable interest to find that the anatomy of *Ariophanta lævipes* is of similar type, the form of the generative organs in this last-named shell presenting no differences of any importance. When I treated of the genus *Ariophanta* in Vol. I. Part III. p. 132, the only animal in spirit I had for examination was one of *A. immerita*. I am now, thanks to Mr. Phipson, in possession of *A. lævipes*, the type species from Bombay, and can supply the needed information.

ARIOPHANTA LÆVIPES. (Continued from Part IV. p. 134.)

*Generative organs* (Pl. LXXX. figs. 5–5 *c*). The penis is a long and narrow sheath, much folded at the middle portion of its length. It then divides into one rather long diverticulum (*k*), to which is attached the retractor muscle; the other is shorter, the kalk-sac, joined by the vas deferens near the middle: this sac is the seat of the spermatophore when in process of formation, which in the specimen examined was very well seen (fig. 5 *b*). The spermatheca (fig. 5 *a*) is globose, on a short narrow stem. Just above the point of junction of this last appendage the main duct is coiled on itself, forming a globose mass, the vas deferens coming in and uniting with the ovo-testis above. The radula (Pl. LXXXII. figs. 4 *a*–4 *d*) is arranged thus—

$$\frac{120 \,.\, 2 \,.\, 8 \,.\, 1 \,.\, 8 \,.\, 2 \,.\, 120}{130 \,.\, 1 \,.\, 130}$$

The centrals are rather short and stout; the centre has strong cusps on either side, the median one cusp on the outer side; the 8th does not show any. From the 9th up to the 12th the notch rises to near the apex, and the following teeth outwards are all evenly bicuspid; the outermost are very small, with a single point.

The jaw (fig. 4) has a small central projection.

There is no doubt now that *Ariophanta* and *Nilgiria*, so far as the animals are concerned, are inseparable. The sinistral growth is not of any importance anatomically, and but for conchological classification, which must not be overlooked, I should not propose to retain *Nilgiria* as a subgenus; but it will facilitate the present and future understanding and arrangement of the group to concentrate all these South-Indian Peninsular shells in a subfamily, the *Ariophantinæ*, retaining *Ariophanta* for the sinistral *lævipes* and its allies and *Nilgiria* for the dextral species like *solata*, *tranquebarica*, &c., which, as I have also shown, have no affinities with either *Hemiplecta* or *Xesta*, in which they have been hitherto placed.

Having got so far in this grouping, closer investigation of both these divisions shows that the radula is not constant in character in either, and that the species can be again divided into those with aculeate laterals and those with bicuspid laterals. It follows that sinistral *lævipes* bears the same relationship to dextral *solata*, *tranquebarica*, &c., that sinistral *immerita*, *cysis*, *bajadera*, &c. do to dextral *bistrialis*. The character of the odontophore being of far greater weight than the coil of the shell, taking the former

character alone, species of *Ariophanta* and *Nilgiria* fall into the following groups :—

| | | |
|---|---|---|
| A. With narrow median band. | | With broad median band. |
| *α*. Median teeth bicuspid. | | |
| Laterals bicuspid...... | *A. lævipes.* | *N. belangeri* (*vide* Semper). |
| B. With broad median band. | | |
| *β*. Median teeth bicuspid. | | |
| Laterals aculeate...... | *A. cysis.* | |
| | *A. immerita.* | |
| *γ*. Median teeth tricuspid. | | |
| Laterals aculeate...... | *A. interrupta.* | *N. bistrialis.* |
| | *A. bajadera.* | |
| | *A. intumescens.* | |
| *δ*. Median teeth tricuspid. | | |
| Laterals bicuspid .............................. | | *N. solata.* |
| | | *N. tranquebarica.* |
| | | *N. maderaspatana* (*vide* Semper). |
| | | *N. ligulata* (*vide* Semper). |

The sinistrorse Helices from the Malay Archipelago placed in *Ariophanta* by Semper, as I have mentioned in Vol. I. p. 133, find no place here. They possess a very different type of radula. The central teeth are either quite plain-sided, as in *amphidroma*, v. Mart. (=*martini*, Pfr.), *rareguttata*, Müll., and *nemorensis*, Mouss., or with side cusps near the apex, as in *striata*, Gray, and *rumphi*, v. d. Busch., and into this last group comes *retrorsa* of Tavoy, of which I have examined a second specimen, collected by Dr. Hungerford. For this group I would propose the subgeneric title *Semperia*, if not already used.

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## EXPLANATION OF PLATE LXX.

Fig. 1. *Cryptosoma innsitatum*, G.-A., × 1·5. Eastern Burmah.
1 *a*. Ditto, nat. size.
2. *Cryptosoma præstans*, Gould, × 1·5. Moulmain.
2 *a*. Ditto, nat. size.
3. *Cryptosoma inusitatum*: view of part of left side, × 1·5.
4. Ditto: the buccal mass from left side, × 4·5.
5. Ditto: jaw, × 8.
6. Ditto: central teeth of odontophore; 6 *a*, 17th to 23rd median; 6 *b*, the outermost laterals, × 196.
7. Ditto: generative organs, × 4·5. Lettering as in former Plates.
7 *a*. The albumen-gland and part of hermaphrodite duct, × 4·5.
7 *b*. The amatorial organ, × 2·5.
7 *c*. Ditto, with fleshy part more exposed, × 4·5.
8. A spermatophore, × 4·5.

*h.d.*, hermaphrodite duct; *r.m.*, retractor muscle; D., dart or amatorial organ; *sp.*, spermatheca; *v.d.*, vas deferens; P., male organ.

## EXPLANATION OF PLATE LXXI.

Fig. 1. *Cryptosoma siamense*, Haines, × 1·5. Siam.
1 *a*. Ditto, nat. size.
2. View of part of left side, showing the left dorsal and shell-lobes, × 1·5.
2 *a*. Posterior side, foot.

Fig. 3. Jaw, × 8.
4. Central teeth of odontophore, × 368.
4 *a.* 18th, 19th, and 20th median, × 368.
4 *b.* 20th, 21st, 22nd, and 23rd median, × 368.
4 *c.* Outermost teeth, × 368.
5. Generative organs, × 4·5.
5 *a.* The male organ, × 8.

## EXPLANATION OF PLATE LXXII.

*Cryptosoma imperator*, Gould. Hongkong.

Fig. 1. Shell, × 1·5.
1 *a.* Shell and animal, nat. size (spirit-specimen), viewed from right side.
1 *b.* Ditto, viewed from left side.
2. Animal with shell removed, viewed from right side, × 4·5.
2 *a.* Ditto, viewed from the posterior side, × 4·5.
2 *b.* View showing left shell- and neck-lobes, × 4·5.
2 *c.* Mucous gland from posterior side, × 4·5.
3. Buccal mass, × 4·5.
4. Jaw, × 4·5.
5. Central teeth of odontophore, × 196.
5 *a.* Median teeth, 11th to 16th, × 368.
5 *b.* Outer lateral teeth, × 196.
6. Generative organs, × 4·5.
6 *a.* The male organ, × 12·4. *x*, the side of the muscular sheath is here broken.

## EXPLANATION OF PLATE LXXIII.

*Damayantia smithi*, Collinge & Godwin-Austen. Borneo.

Fig. 1. Animal, from right side (from spirit-specimen), × 2·5.
1 *a.* Ditto, from above, × 2·5.
1 *b.* Ditto, from left side, × 2·5.
2. Shell, × 2·5.
3. The visceral sac, shell removed, exposed, seen from above, showing single coil, × 2·5.
4. Extremity of foot, showing mucous gland, × 8.
5. Jaw, × 12.
6. Central teeth of radula, × 368.
7. Generative organs (*sp.am.*), × 4.
7 *a.* Ovo-testes and hermaphrodite duct, × 8.
7 *b.* Portion of male organ, × 8.
7 *c.* Ditto, another view, × 8.
7 *d.* The calcareous dart in the amatorial organ, × 8.

## EXPLANATION OF PLATE LXXIV.

*Microparmarion simrothi*, Collinge & Godwin-Austen. Borneo.

Fig. 1. Shell and part of mantle from above, × 3.
1 *a.* As seen from left side, × 3.
1 *b.* Head and fore portion of body and mantle, right side, × 4.
2. View of right side of animal, shell removed, × 4.
3. Portion of œsophagus, with salivary gland, × 4.
4. Jaw, × 4.
5. Generative organs, × 4.
5 *a.* Male organ, × 8.
5 *b.* The calcareous dart in the amatorial organ, × 12·5.
6. Generative organs of *Parmarion pupillaris*, after Semper.
6 *a.* Calcareous dart (the "Liebesfeil"), after Semper.
6 *b.* Teeth of radula, after Semper.

## EXPLANATION OF PLATE LXXV.

*Microparmarion pollonerai*, Collinge & Godwin-Austen. Borneo.

Fig. 1. Animal, from above (spirit-specimen), × 2·4.
2. Ditto, right side, × 2·4.
3. Mucous gland, × 4·6.
4. Posterior end of visceral mass, shell removed, × 8.
5. Buccal mass and salivary glands, × 8.
6. Jaw, × 12.
6 *a*. Central teeth of radula, × 368.
6 *b*. Lateral teeth of radula, × 368.
7. Generative organs, × 4.
7 *a*. Male organ, with kalk-sac, × 4.
7 *b*. Ditto, muscular sac cut open.
7 *c*. Interior of kalk-sac, showing the papillate surface, × 8.
7 *d*. The calcareous dart of the amatorial organ, × 8.

## EXPLANATION OF PLATE LXXVI.

*Durgella levicula*, Benson. Tenasserim.

Fig. 1, 1 *a*, 1 *b*. Shell, × 4.
2. Animal, seen from right side (from spirit-specimen).
2 *a*. Ditto, from left side, much enlarged.
2 *b*. Extremity of foot, as in life.
3. Buccal mass, from right side.
4. Jaw, × 58.
5. Centre tooth of the radula, with two laterals, very much enlarged.
5 *a*. Lateral teeth.
6. Generative organs, × 8.
6 *a*. The male organ, showing muscular dart, × 12·4.

## EXPLANATION OF PLATE LXXVII.

Fig. 1. *Durgella assamica*, G.-A.: shell, × 4. Durrang District, Assam.
2. Ditto: portion of side of foot, much enlarged.
3. Ditto: shell and dorsal lobes detached.
4. Ditto: jaw, × 30.
5. Ditto: lateral teeth.
5 *a*. Ditto: lateral teeth, much enlarged.
6. Ditto: generative organs. Lettering as in other Plates.
7, 7 *a*. *Durgella mairangensis*, G.-A., × 4. Khasi Hills.
7 *b*, 7 *c*. Ditto, × 2·4.
8. Ditto: extremity of foot.
9. Ditto: jaw, × 12·4.
10. Ditto: central tooth and side teeth, enlarged.
10 *a*. Ditto: outermost laterals, × 368.
10 *b*. Ditto: five laterals, very much enlarged.
11. Ditto: generative organs, portion of, × 12·4.

## EXPLANATION OF PLATE LXXVIII.

*Durgella dekhanensis*, Godwin-Austen. South India.

Fig. 1. Shell, × 2·5.
2. Animal and shell (spirit-specimen), showing shell-lobes, × 1·5.
2 *a*. Ditto, part of, from the left side, × 1·5.
2 *b*. Extremity of foot, showing mucous pores, × 8.
2 *c*. Portion of sole of foot, × 8.
2 *d*. Mantle-lobes detached: *r.s.l.*, right shell-lobe &c.

*Durgella dekhanensis*, var. *bicolor*.

Fig. 3. Animal and shell, × 1·4.
4. Jaw, × 24.
5. Generative organs, × 4.

*Durgella levidensis*, Godwin-Austen. Travancore.

Fig. 6. Animal, viewed from the right side (spirit-specimen), × 4.
7. Generative organs, × 4.
7 *a*. Male organ, opened out on side, × 4.
7 *b*. Ditto, end of, enlarged, side view.
8. Four lateral teeth of odontophore, very much enlarged.
8 *a*. The central tooth and outer laterals, × 368.
9. The buccal mass, × 4.

## EXPLANATION OF PLATE LXXIX.

Fig. 1. *Durgella christianæ*, Theobald: shell, × 4. Andaman Islands.
2. Ditto: animal viewed from right side (from spirit-specimen).
3. Ditto: jaw, × 12·4.
4. Ditto: central tooth and adjacent teeth, much magnified.
4 *a*, 4 *b*. Ditto: laterals, very much enlarged.
5. Ditto: generative organs; ? the probable position of the retractor muscle of the penis.
6, 6 *a*. *Durgella ? sumbaensis*, G.-A.: shell, × 4. Sumba or Sumbawa.
6 *b*. Ditto: animal after soaking in water, showing the right shell-lobe, × 4.
7. Ditto: jaw, × 30.
8. Ditto: central tooth and five median teeth.
8 *a*. Ditto: lateral teeth, very much enlarged.
8 *b*. Ditto: the outer laterals, very much enlarged.
9. *Durgella hosei*, G.-A.: central tooth and adjacent laterals. Borneo.
10. *Durgella dekhanensis*, G.-A.: extremity of foot, showing a supernumerary overhanging lobe to mucous gland, × 4. South India.

## EXPLANATION OF PLATE LXXX.

*Nilgiria solata*, Benson. Nilghiri Hills.

Fig. 1. Shell, × 1·5.
2. Animal viewed from right side, showing edge of mantle and dorsal lobes, × 1·5.
2 *a*. Ditto, from left and front side, showing sole of foot, × 1·5.
3. Extremity of foot, showing mucous gland, × 4.
4. Generative organs, × 4.
4 *a*. Generative (male) organ, × 8.

*Ariophanta lævipes*, Müller. Bombay.

Fig. 5. Generative organs, amatorial organ detached, × 4.
5 *a*. Ditto, portion of, showing spermatheca.
5 *b*. Ditto, portion of male organ near junction of vas deferens, showing spermatophore *in situ*, × 12.
5 *c*. Ditto, terminal end of the amatorial organ, × 12.

*Hemiplecta humphreysiana*, Lea. Singapur.

Fig. 6. Animal, front view, showing shell- and dorsal lobes, × 2·4.
6 *a*. Ditto, viewed from the left side, showing edge of mantle and left dorsal lobe, × 2·4.
6 *b*. The generative organs, nat. size.

## EXPLANATION OF PLATE LXXXI.

Fig. 1. *Hemiplecta humphreysiana*, Lea: central tooth, × 368. Singapur.
1 *a*. Ditto: central teeth, × 275.
1 *b*. Ditto: 27th, 28th, and 29th centrals, × 368.
1 *c*. Ditto: 59th, 60th, and 61st laterals, × 368.
1 *d*. Ditto: 132nd, 133rd, and 134th laterals, × 368, and outermost teeth.
1 *e*. Ditto: jaw, × 8.
2. *Hemiplecta densa*, Adams & Reeve: central teeth, × 368. Borneo.
2 *a*. Ditto: 16th, 17th, and 18th median teeth, × 368.
2 *b*. Ditto: three laterals, × 368.
2 *c*. Ditto: jaw, × 8.
3. *Nilgiria tranquebarica*, Fabr.: mantle-edge and dorsal lobes removed, × 2. Madras.
3 *a*. Ditto: genitalia, × 4.
3 *b*. Ditto: another specimen, × 4.
3 *c*. Ditto: spermatophore, × 8.
3 *d*. Ditto: ditto, portion near base of the sac, × 24.
4. *Nilgiria bistrialis*, Beck: genitalia, × 4. Madras.
4 *a*. Ditto: the basal portion of amatorial organ, showing the "rod-point," or *virgula amatoria*.

## EXPLANATION OF PLATE LXXXII.

Fig. 1. *Hemiplecta uter*, Theobald: jaw, × 8. Tenasserim.
1 *a*. Ditto: central teeth, × 368.
1 *b*. Ditto: median teeth, 13th to 16th, × 368.
1 *c*. Ditto: laterals, 52nd to 56th, × 368.
1 *d*. Ditto: outer laterals, × 368.
2. *Nilgiria solata*, Bs.: jaw, × 8. Nilghiri Hills.
2 *a*. Ditto: central teeth, × 275.
2 *b*. Ditto: median and transition teeth, 17th to 23rd, × 275.
2 *c*. Ditto: three laterals, × 368.
3. *Nilgiria tranquebarica*, Fabr.: jaw, × 8. Madras.
3 *a*. Ditto: central teeth, × 275.
3 *b*. Ditto: median teeth, 17th to 20th, × 368.
3 *c*. Ditto: laterals, × 368.
4. *Ariophanta lævipes*, Müller: jaw, × 8. Bombay.
4 *a*. Ditto: central teeth, ×368.
4 *b*. Ditto: median teeth, 8th to 12th, × 368.
4 *c*. Ditto: laterals, 101st to 104th, × 368.
4 *d*. Ditto: six outermost teeth, × 368.
5. *Nilgiria bistrialis*, Beck: jaw, × 8. Madras.
5 *a*. Ditto: two centre teeth, × 368.
5 *b*. Ditto: median teeth, 18th and 19th transition teeth, × 368.
5 *c*. Ditto: middle laterals, × 368.
5 *d*. Ditto: outermost teeth, × 368.
6. *Ariophanta immerita*, W. T. Blf.: jaw, × 8. South India.
6 *a*. Ditto: three central teeth, × 196.
6 *b*. Ditto: median transition teeth, 24th to 26th, × 196.
6 *c*. Ditto: laterals, 38th, 39th, and 40th, × 196.
7. *Ariophanta cysis*, Benson: central teeth, × 196. Nilghiri Hills.
7 *a*. Ditto: median transition teeth, 21st, 22nd, and 23rd.
7 *b*. Ditto: three laterals, × 196.
7 *c*. Ditto: five outermost teeth, × 196.
8. *Ariophanta? bajadera*, Pfr.: three central teeth, × 368. Bombay.
8 *a*. Ditto: median transition teeth, 22nd and 23rd, × 368.
8 *b*. Ditto: lateral teeth, 33rd, 34th, and 35th, × 368.

# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA,

INCLUDING

SOUTH ARABIA, BALUCHISTAN, AFGHANISTAN, KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM, MALAY PENINSULA, CEYLON, AND OTHER ISLANDS OF THE INDIAN OCEAN.

SUPPLEMENTARY TO MESSRS. THEOBALD AND HANLEY'S

## CONCHOLOGIA INDICA.

BY

LIEUT.-COLONEL H. H. GODWIN-AUSTEN,
F.R.S., F.R.G.S., F.Z.S., &c.,
LATE DEPUTY SUPERINTENDENT TOPOGRAPHICAL SURVEY OF INDIA, IN CHARGE OF THE KHASI, GARO, AND NAGA-HILLS SURVEY PARTY.

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*apertura obliqua, lunari, latiuscula, peristomate tenuissimo, intus non labiato, margine columellari superne breviter reflexo.*

"Diam. major 32, minor 28, axis 14 mill.

"Habitat prope Bombay et Ahmednugger.

"I have had specimens of this shell from Dr. Jerdon, Major H. Alexander, Mr. Fairbank, and others. Mr. Shurtleff assigns it to *H. labiata*. It has also been considered a variety of *H. vitrinoides*. Besides its great thinness, the absence of any labiation inside the peristome, and of the colours observable in the aperture of *H. labiata*, Pfr., which I discovered, in 1838, in the Western Himalaya, it is distinguished by its subangular periphery and marginate suture from that and any other allied form."

*Shell.* The surface of the shell under high power is quite smooth, with not a trace of any longitudinal striation.

*Animal.* Pale throughout, with a pale grey neck; surface of the body rather smooth. *The sole of the foot is divided* *. The peripodial groove as usual, but not very broadly fringed below; the grooves running from it upwards to the keel of the foot behind are set at very regular intervals. There is a very short rudimentary right shell-lobe (fig. 1, *rsl*), which in life cannot be extended very far over the shell; there is also a pointed small left shell-lobe, given off from a narrow border on the margin of the peristome at the left lower side. The right dorsal lobe is ample, the left is in two separate parts, with a wide interval between them; the anterior portion does not extend far and has a long lobe, the posterior part is narrow and rather short. The mucous pore just extends to the margin of the foot; the extremity is rather square.

The odontophore has this arrangement of the teeth :—

44 . 3 . 14 . 1 . 14 . 3 . 44
61 . 1 . 61

Central tooth tricuspid, cusps basal; the median teeth tricuspid, the outer cusp basal, the inner high; laterals elongate, curved, bicuspid, the outer much below the apical one.

*Generative organs* (fig. 2). The penis is folded on itself below the retractor muscle, and a large portion of this bend is coalesced together forming a thickened cylindrical mass, pointed above and there giving off the retractor muscle. Closer examination of this portion (*crp*) shows that it is bent over near the muscle attachment for about 5 mm. of the terminal end (fig. 3 *a*). This tube or sheath is continued downwards to the generative aperture; the free portion is 5 mm. or more up to the junction of the vas deferens, and here is a long thick blunt-ended flagellum or kalk-sac, 8 mm. in length. When in natural position the flagellum is folded and lies close beside the main sheath, about the middle of its length (see fig. 3).

* Care is necessary in the examination of the foot; in some cases bad preservation in alcohol obliterates the lines of division, so that the middle and side areas are not distinguishable. A series of specimens, as in this case, settled the point.

The spermatheca is very long, swelling out slightly towards its free extremity, and lies buried in the coils of the oviduct. Just below the point where the vas deferens leaves the side of the oviduct the uterus is bent into a sharp fold.

The amatorial organ is long and cylindrical, tapering to a point and giving off a retractor muscle. On cutting open the anterior thickened end or atrium (fig. 4) the blunt papilla of the dart is exposed: in this species it has a papillose surface. The interior of this atrium is wrinkled concentrically, indicating its contractile nature. The amatorial organ itself (fig. 4 *a*) consists of a flexible pointed rod of concentric structure, 0·75 mm. in diameter, having a central nucleus, and surrounded outside by a glandular mass radiating from it (fig. 4 *b*).

It may be noticed that the base of the spermatheca in my drawing (fig. 2) is very rounded and even in outline. This was due to the sac being literally full of spermatophores, no less than seven. It was one of the most beautiful objects I have ever dissected out, for the state of their preservation was perfect, and I show, by dotted lines, how they were packed away inside the spermatheca. The spermatophore (fig. 5) is of delicate and graceful outline, and unlike any I have seen before in the great length of the canal or "flume," which measures 38 mm. in total length, of which the capsule is 10 mm. The spines on the marginal sides (fig. 5 *b*) of the "flume" are set at regular intervals and branch into two points, which sometimes are again bifid. They are larger close to the base of the capsule, where there are three strong simple spikes (fig. 5 *a*). This capsule is beautifully transparent and terminates in a hard solid point. Some of the capsules were quite empty, others were full of a granular mass, representing, I presume, the remains of the spermatozoa that once filled it.

The hermaphrodite-duct (fig. 2 *a*) is very large, joining the albumen-gland by a very closely convoluted tube. The ova testis was not extracted from the lobe of the liver, in which it was closely imbedded.

In all important characters except one (the male organ) this species is a *Macrochlamys*, but it is a section of the genus, more correctly, perhaps, a link with it. The shell-lobes show this, the most noticeable difference being the very moderate development of the right shell-lobe. In the generative organs the manner in which the retractor muscle is given off recalls its position in *Girasia* and *Austenia*; but closer examination shows a considerable difference in the presence of a sharp bended cæcum (fig. 3 *a*) at this point, and this is an interesting approach to the diverticular coil so well developed in true *Macrochlamys*, in *Oxytes*, and in *Bensonia*. The flagellum of *M. pedina* is far longer than in *Girasia*, and thus, again, it more resembles *M. hardwickei*, &c. (See Plate XXVIII. figs. 1, 1 *a*, Vol. I.)

From *Ariophanta* and *Nilgiria* it differs completely in having a long spermatheca, but a somewhat similar type of male organ: the spermatophore also may be compared with that of *Nilgiria tranquebarica*; the difference is very great (*vide* Plate LXXXI. figs. 3 *c*,

3 *d*), and presents well-marked differences. In external character there is much diversity in the shell- and dorsal lobes.

### Subgenus Eurychlamys, nov.

The two species which will now be described in full possess so many striking characters not found hitherto in other Indian species that I have felt it necessary to create a new subgenus under the above title (indicated in Presidential Address, Proc. Malacol. Soc. of London, vol. iii. no. 5, p. 250, read 10th February, 1899).

### *Description of the Subgenus.*

The shell-lobes are elongate and broad, more or less papillate, enveloping the shell. The left dorsal is divided into two lobes, the posterior one narrow. Lobe above mucous gland overhanging. Foot long and narrow behind, the sole with central and marginal areas. In the genitalia the male organ is a simple straight sheath, the retractor muscle attached at the end, and above a small bulbous enlargement where the vas deferens joins. The amatorial organ is absent. The jaw has a central projection. The central tooth is tricuspid, the median teeth bicuspid, the laterals evenly bicuspid (from 70 to 60 on each side).

In a species, *planospira*, inhabiting Sikkim are found all the above characters, with the exception of possessing the amatorial organ; and it is thus apparently nearer to this subgenus than to *Austenia*, in which it was first placed by me, principally on shell-characters and the ample shell-lobes.

Eurychlamys platychlamys, W. T. Blanford. (Plate LXXXIV. figs. 1–1 *e*.)

*Macrochlamys? platychlamys*, W. T. Blanford, Journ. A. S. B. vol. xlix. pt. 2, 1880, p. 195, pl. ii. fig. 9.

*Nanina* (sec. *Macrochlamys*) *platychlamys*, Tryon, Man. Conch. 2nd ser. vol. ii. p. 91, figs. 70, 71.

Original description [Plate LXXXIV. fig. 1 *b*]:—"*Testa perforata, conoideo-depressa, pertenuis, nitida, lævigata, sub lente obsolete striatula, fulvo-cornea. Spira parum elevata, apice obtuso, suturâ levi aliquando marginatâ. Anfr.* 5, *vix convexiusculi, regulariter accrescentes; ultimus non descendens, peripheriâ rotundatus, subtus convexus. Apertura obliqua, lunaris, latior quam alta. Peristoma tenue, simplex, leviter sinuatum, marginibus remotis, callo tenuissimo junctis, columellari brevissime verticali, peranguste reflexo.*

"Diam. maj. 11, min. $9\frac{1}{2}$, axis $5\frac{1}{2}$ mill.

"Animal pallio maximo indutum, duos lobos latos linguæformes emittente, qui spiram testæ omnino circumtegunt.

"*Hab.* Bombay.

"Shell perforate, conoidly depressed, very thin, smooth, and polished, obsoletely striated beneath the lens, fulvous-horny in

colour. Spire subconical, but little raised, apex obtuse; suture smooth, scarcely impressed, sometimes marginate. Whorls 5, very slightly convex, regularly increasing in size, the last not descending, rounded at the periphery, convex below. Aperture oblique, lunate, broader than high. Peristome thin, simple, slightly curved when viewed from the side; margins distant and united by a thin callus; the columellar border vertical for a very short distance, slightly reflexed.

"Major diameter 0·44, minor 0·38, axis 0·22 inch.

"This shell belongs to the group of thin, more or less depressed forms allied to the type usually known as *M. vitrinoides* (*M. indicus*), Benson. It appears, so far as I can see, to be undescribed, as is also, I believe, an allied form of darker colour, and with a subangulate periphery, occurring at Trichinopoly and elsewhere in the neighbourhood of the Coromandel coast south of Madras. The animal of *M. platychlamys* is chiefly distinguished by the peculiarly broad shell-lobes, which, instead of being narrow and attenuate towards the ends, as in most species, are broad and flat, so as sometimes to cover the whole spire, and usually to conceal all except a narrow band. These lobes somewhat resemble those of *Helicarion*. The lobe above the caudal gland is very much smaller than it usually is in *Macrochlamys*, and rounded, not horn-shaped.

"This shell is common in the island of Bombay and neighbouring lowlands on the west coast of India, and I have seen a form from the hills of the Wynaad in Southern India that appears undistinguishable. I have also several specimens of a *Macrochlamys* from the ancient town of Champanir, near Broach, that may very possibly be a variety of *M. platychlamys*. The specimens are larger than the Bombay types, an adult measuring 16 mm. by 14 mm. in its two diameters, and some individuals attain even greater dimensions; the mouth, too, is rather more convex beneath, but otherwise the two forms agree very closely. The figure (in Journ. Asiat. Soc. Bengal) gives the idea of a rather thick shell, and the form of the mouth is incorrect, being too convex below, and consequently too high in comparison with the breadth."

The surface of the shell above, highly magnified, shows no longitudinal striation, only the irregular transverse streaks of growth, on the under surface; distant, parallel, fine striation, at irregular distances, is very well seen.

*Animal* (Pl. LXXXIV. figs. 1, 1 *a*). Very dark grey, the lobe over the mucous gland rather large; the usual peripodial line and fringe. Sole of foot with a strongly marked central area. A very long right shell-lobe, wide near the respiratory orifice, and narrowing posteriorly. The left shell-lobe very broad and quadrate in outline and lengthened. Both these lobes are very black and papillate.

The buccal mass is compact and globose; the salivary glands are in two distinct masses.

*The odontophore.* The central tooth has broad strong cusps on both sides, about halfway down the basal plate. The median teeth

all have an upper inner cusp and an outer lower one. The laterals are bicuspid, the outer cusp well below the inner.

$$+45 \;.\; 2 \;.\; 12 \;.\; 1 \;.\; 12 \;.\; 2 \;.\; 45+$$
$$+59 \;.\; 1 \;.\; 59+$$

The jaw (fig. 1 *c*) has a central projection.

*Generative organs* (figs. 1 *d*, 1 *e*). The penis (fig. 1 *e*) consists of a simple, rather short, bulbous sheath; the vas deferens given off near the summit, as is also the retractor muscle. Spermatheca moderately long. Amatorial organ absent.

EURYCHLAMYS REGULATA, Benson. (Plate LXXXIV. figs. 2 *a–g*.)

*Helix regulata*, Benson, A. M. N. H. ser. 3, 1860, v. p. 383; Pfr. Mon. Hel. vol. v. p. 125; Tryon, Man. Conch. p. 96, vol. ii. pl. 32; figs. 39, 40; Hanley, Conch. Ind. p. 15, pl. xxxi. figs. 5, 6.

*Macrochlamys regulata*, Clessin, Nomen. Helic. p. 44.

Original description:—"*Testa vix perforata, depressa, tenui, oblique obsolete striatula, utroque spiraliter elegantissime acuducto-striata, fusco-cornea, pellucida, politissima; spira depresso-conoidea, apice obtusiusculo, sutura impressa submarginata; anfractibus* 3½ *convexiusculis, celeriter accrescentibus, ultimo ad peripheriam subangulato, subtus convexiore, antice non descendente; apertura ampla, obliqua, rotundato-lunari, peristomate recto, acuto, margine columellari arcuatim descendente, superne supra perforationem reflexiusculo, marginibus remotis subconniventibus, callo tenui junctis.*

"Diam. major 11, minor 9, axis 6 mill.

"Habitat ad Kaluganga, pagi Matelle orientalis, necnon ad Katukellekande.

"Distinct in appearance from any of the known small translucent Helices of Ceylon, and remarkable for the beautiful spiral impressed sculpture on both sides."

The sculpture of the shell is shown, on fig. 2 *c*, near the suture. Parallel regular longitudinal striation crossed by streaks of growth.

*Animal* (Plate LXXXIV. figs. 2, 2 *a*). Foot long behind, the lobe over the mucous gland elongate and curving over even in the spirit-specimen. The shell-lobes are broad, given off from the mantle-edge, and narrow gradually to a point, and would cover the greater part of the shell in life.

The male organ (fig. 2 *g*) is a simple long sheath, the vas deferens joining it at the top with a slight swelling. The retractor muscle joins above this and is very short. There is no amatorial organ; in this respect this species is closer to the *Helicarion*-like shells of South India and Ceylon.

In the odontophore (fig. 2 *f*) the centre tooth is tricuspid, cusps basal; the median teeth with one cusp on the outer side; nearly even pointed bicuspid laterals, becoming very minute on the margin. Jaw (fig. 2 *e*) convex above, concave below, with a central projection.

Dental formula:—

55 . 2 . 12 . 1 . 12 . 2 . 55
69 . 1 . 69

Specimens here described were sent me by Mr. O. Collett from Badulla, Ceylon.

*Austenia planospira*, Benson, was figured and described by me in Vol. I. p. 149 (Plates XXXVI. & XXXVIII.) from specimens obtained at Damsang, on the outer Bhutan Hills near Darjiling. I have since examined other specimens from near Cheung-tong, near the junction of the Lachen and the Lachung rivers in Sikkim, at 10,000 feet, collected by Mr. W. Roberts. They present the same characters; radula exactly the same. It may be noted that the generative organs (fig. 1, Plate XXXVIII.) show that the penis is exactly of the same type as in *Eurychlamys*, quite simple: it differs from this genus in possessing an amatorial organ: the shell-lobes are very similar; there is thus a departure in the genitalia from *Austenia*, but, on the other hand, the teeth of the radula are like *Macrochlamys indica* (Plate XVIII. figs 8–8 *b*). Tricuspid median teeth, and the outer point of the laterals far below the inner one, typical of *Austenia.*

Under these circumstances it is not an easy matter to decide in what genus this species should be placed. I was inclined to think the simpler form of the male organ might be due to the smaller size of the animal; but this is not borne out by the form of the same organ in shells even smaller, in which may be seen all the details characteristic of *Macrochlamys*. For additional remarks see under *Austenia*, further on.

*Microcystis dyakana*, G.-A., from Borneo, described by me in the P. Z. S. 1891, p. 37, pl. iv. figs. 4 *a–c*, is, in the type of the shell, the form of the shell-lobes, and the male organ, remarkably like these two Peninsular Indian species. Compare the latter organ and the bulbous swelling at the point of connection of the vas deferens.

### Subgenus Ratnadvipia, nov.

(Alluded to in Presidential Address, Proc. Malacol. Soc. London, vol. iii. no. 5, p. 253.)

Ratnadvipia irradians, Pfr. (Plate LXXXV. figs. 1–8 *a*.)

*Vitrina irradians*, Pfeiffer, P. Z. S. 1852, p. 156; id. Mon. Hel. vol. iii. p. 3; Reeve, Conch. Icon. pl. i. fig. 5; Hanley, Conch. Ind. p. 29, pl. lxvi. figs. 8, 9.

*Helicarion* (sec. C) *irradians*, Theob. Supp. Cat. p. 24.

*Helicarion irradians*, Nevill, Hand-list, p. 15; Clessin, Nomen. Helic. 1881, p. 31; Tryon, Man. Conch. 1885, p. 176, pl. 40. fig. 33.

Original description [Plate LXXXV. figs. 5, 5 *a*]:—"V. *testa depressa, ambitu subauriformi, tenui, lineis impressis confertim*

*arcuato-radiata, lineis irregularibus spiralibus obsolete decussata, diaphana, vix nitidula, superne cinnamomeo-cornea; spira parvula, subpapillatim elevata; sutura impressa, marginata; anfract. fere 4 planiusculis, rapide accrescentibus, ultimo depresso, basi convexiore; apertura perobliqua, lunato-subcirculari; perist. simplice, tenui, margine columellari regulariter arcuato.*

"Diam. $18\frac{1}{2}$, alt. 8 mill.

"*Hab.* in insula Ceylon."

In Mon. Hel.:—" Var. *β. major, spira vix elevata*: diam. maj. 25, min. 19, alt. 11 mill."

Dimensions of shell dissected [Kegalle, Ceylon, 600 ft., on cacao-trees (*O. Collett*)]:—

Major diam. 21·5, minor diam. 17 mm.

Dimensions of a dark blue-grey specimen preserved in alcohol [Botanical Gardens, Peradeniya, Ceylon (*Freeman*)]:—

Major diam. 22·75, minor diam. 17·5 mm.

This is very dark about the head, paling towards the hinder part. Another specimen appears to have been dark olivaceous in life. It shows that it varies much in coloration.

*Animal* (fig. 1). Grey, with very pale (? yellow) tentacles. The right shell-lobe has a tongue-shaped expansion at the side of the respiratory orifice; it then narrows and is continued backward into a narrow fillet. The right dorsal lobe is large and extends backward to the posterior side of the shell. The left shell-lobe (fig. 2), commencing at the respiratory orifice, is narrow; it widens gradually, throws off a little tongue-shaped portion, and then narrows again slightly to cover the posterior side of the shell. The left dorsal lobe (fig. 2) is very ample and distinctly divided into two portions. The great development of the dorsal lobes is a conspicuous character in this species.

The underside of the foot (fig. 3) is folded down the middle, and has fine segmental lines running from the peripodial edge up to it; in this feature it is not in the least like the sole of the foot in *Girasia* or even in species of *Durgella*, such as *D. dekhanensis*. Under the lens the surface is seen to be longitudinally striate *.

Total length of specimen in spirit 40 mm., breadth of foot 9 mm.; from the extremity of foot to posterior side of shell 13 mm.; left dorsal lobe from respiratory aperture to front edge 12 mm.; breadth of right dorsal lobe 12 mm.

In the odontophore (fig. 8) the centrals are plain-sided, bluntly pointed teeth; at the 22nd and 23rd median a slight notch near the apex is apparent; the 24th tooth is evenly bicuspid, and it is succeeded by no less than 180 similar formed teeth very gradually decreasing in size; next follow about 24 very minute teeth, which are unicuspid.

* In some specimens I have seen, through the kindness of Mr. Martin Woodward, very hardened by alcohol, the central folding is not so marked; still there is no defined central area.

The dental formula is—

$$\frac{204\ .\ 23\ .\ 1\ .\ 23\ .\ 204}{227\ .\ 1\ .\ 227}$$

The jaw (fig. 7) is by no means strongly or solidly developed; it has a simple slightly concave cutting-edge. There is no defined upper margin; this edge merges into the muscular tissue: or, in other words, the jaw does not come away in one solid mass, as it does in most other species of the Zonitidæ.

This type of odontophore is seen in *Hemiplecta uter*, Theob., and *H. humphreysiana*, Lea, only that the breadth of the radula is greater in the Ceylon mollusc, there being 160 more teeth in the row. The jaw is also without the central projection in these two species.

*The generative system* (figs. 6, 6 *a*). There is a large amatorial organ, having a sharp S-like bend, near the genital aperture. The male organ is very simple—a moderately long sheath, with a large bulbous swelling, to which the vas deferens is connected; a long, solid sheath continues above this, to which the retractor muscle is attached. This bulbous swelling represents the kalk-sac in a very shortened form, and is probably continued in a bend within the solid sheath, which represents the *cæcum musculi retractoris penis* of Semper.

Compared with *Cryptosoma* (Plates IV. & LXX.–LXXII.), there are many important differences in the radula and jaw, in the form of the amatorial and male organs, and particularly in the sole of the foot. I have noticed that in many of the Cingalese species the foot, after preservation in alcohol, contracts upon a central line, which is never the case in *Macrochlamys*, *Girasia*, &c. This indicates, I think, that similar contraction prevails in life, and perhaps points to an arboreal habit of the animal. The two genera last mentioned are essentially terrestrial, and are not to be sought for, as a rule, on shrubs far above the ground, although occasionally in very wet weather they may some of them be found there.

*Cryptosoma insusitatum*, in the form of the dart (Plate LXX. figs. 7 *b*, 7 *c*), shows a decided approach to the Malayan *Microparmarion*, only it has not become calcareous, but it is protrusive to a considerable extent.

Still greater differences may be noted between *R. irradians* and *Durgella christianiæ* (Plate LXXIX.), as also when it is placed beside the South-Indian forms, such as *Durgella dekhanensis* (Plate LXXVIII.). I therefore consider a new subgenus must be created for it, and that the grounds for doing so are sufficient.

### *Description of subgenus* RATNADVIPIA.

(The old Sanscrit name of Ceylon, compounded of
"Ratna," a jewel, "Dwip," an island.)

*Animal.* The right shell-lobe is in two parts; above, near the respiratory orifice, a tongue-shaped process plays over the upper

surface of the shell; below this, following the body-wall, a broad elongate lobe covers the underside, and passes backward behind the shell in a narrow fringe to unite with the left shell-lobe. This is narrow throughout, just overlapping the peristome; a small tongue-shaped process is given off on the left margin, similar to that of typical *Macrochlamys.* The dorsal lobes are very much developed, the left dorsal one is in two parts.

*Genitalia.* The amatorial organ present. The male organ is simple, the kalk-sac very small, represented by a bulbous swelling; above this there is a sharp bend in the sheath, the retractor muscle rising from the end of it.

Jaw with a slight concave edge, soft in structure, and merging on its upperside into the muscular tissue.

The odontophore has plain, straight-sided, rather bluntly pointed teeth in the middle area; the numerous laterals are evenly bicuspid.

The radula is broad, and has over 200 teeth on each side.

Shell with few whorls, thin, transparent; body-whorl large.

As to its phylogeny. It is of much interest to compare the male organ (*vide* Plate LXXXV. fig. 6) with that of *Euplecta*, for if the very short tube between the bulbous kalk-sac and the base of the muscular retractor muscle were greatly lengthened we should have precisely the same loop as seen in Plate LXXXVI. fig. 4 *b*. Yet still more like is the male organ to that of *Nilgiria chenui* (Plate XCVI. figs. 6 & 7) and *Ariophanta dalyi* (Plate XCVIII. fig. 4). It shows that, as regards this part of the internal anatomy, the relationship of this genus is with these genera of the Ariophantinæ.

### Genus Euplecta, Semper. (Plates LXXXVI. & LXXXVII.)

A list of species included in the genus was published by me in 1897, in the 'Proceedings of the Malacological Society,' vol. ii. pt. 4, p. 173, and I extract a portion of what I then wrote:—

"In 1880 Mr. W. T. Blanford * referred to Semper's work, and pointed out the confusion that inevitably arises from describing two species as the type of a genus and adopted the one that stood first, viz. *E. subopaca.* There are several marked differences between this and Semper's second species, *E. layardi.* The jaw of the first has a central projection, while in *E. layardi* there is none; in the radula the elongate form of the central teeth of the first species is very different to the shorter blunter form of the second; the number of teeth in each row is as 100 to 140–160 respectively, this being the most striking difference. . . . The genitalia of these two species are, however, very much alike; in both there is a short sessile spermatheca, perhaps a more important generic character and one less liable to change than the odontophore. . . . Mr. Blanford was the first to examine this genus from an anatomical point of view, when treating of the position of other Indian species unknown at the time of Semper."

* Journ. Asiat. Soc. Bengal, vol. xlix. pt. 2 (1880), p. 191.

Taking the external form of the animal and the radula he placed in *Euplecta* a number of Eastern and Himalayan and Assam species, where it is correct they should remain until examination of the internal anatomy, especially the generative organs, should prove them something very different to that which Semper has shown *E. subopaca* to be. He placed in the genus :—

*E. subopaca*, Pfr. Ceylon.
*E. layardi*, Pfr. Ceylon.
*E. rotundata*, Semper. Digollorin.
*E. bicarinata*, Semper. Luzon.

But he is doubtful concerning the correct generic position of the last two.

Blanford added the following species :—

*Euplecta pansa*, Bs. Burmah.
*E. sikrigulliensis*, Nevill. Behar. Since found to be a *Macrochlamys* *.
*E. climacterica*, Bs. Assam Hills.
*E. austeni*, W. Blf. Garo Hills. [In my 'Field-notes' there is no reference to any shell-lobes.]
*E. falcata*, W. Blf. Garo Hills.
*E. ornatissima*, Bs. Sikkim.
*E. serrula*, Bs. Teria Ghats.
*E. anceps*, Gould. Tenasserim. [Is a *Macrochlamys*, as noted by Blanford and since observed by myself.]
*E. arata*, W. Blf. North Burmah.

Geoffr. Nevill, in his amended Hand-list, placed these species and a great many more in this genus, and further divided it into two divisions based on shell-character, retaining the more globose, convex-sided shells in *Euplecta*, and created a new subgenus for the sharply keeled species.

Having received some Ceylon shells from Mr. E. R. Sykes, my first examination of the animal was made from a very indifferent dried-up specimen which I described in 1897, a species which I believed to be new, and which I named *Euplecta prestoni* after its discoverer; the animal was, however, not in a state from which any very satisfactory knowledge of the anatomy could be expected. Although many residents in Ceylon have collected the land-shells of the island, no one has done better service towards our malacological knowledge of the fauna than Mr. O. Collett; both he and Mr. Preston have given a stimulus to Indian conchology that was sadly wanting. The fine series of species I have since had the good fortune to examine in detail will ever be associated with Mr. Collett's careful collection and preservation.

Among these was the very beautifully formed shell *E. præeminens*, Sykes, also a fine example of *E. partita*, Bs. =*subopaca*, Pfr., the

* Animal figured in Land & Freshw. Moll. India, Part III. Pl. XIX. figs. 3, 3 *a*, from Stoliczka's set of drawings.

type species of the genus. Its size promised to give results of value, and these I have now the pleasure of publishing, while by a greater enlargement of anatomical detail the generative organs are better shown than in those of the same species given by Semper. He depicts the genitalia unravelled and extended in a way they are not seen in nature, and it is this natural position, bound and confined by strong muscular bands into the space it has to fill, which gives this genus its distinctive character when compared closely with the anatomy of other genera. This examination has rather led me to doubt whether any near relationship will be found with species like *E.? climacterica* and *E.? vidua* of the N.E. frontier*. I would here, in support of this view, point out how very different is the sculpture of these last when examined under a high power. In *subopaca* the transverse sculpture is produced by undulations of the shell-growth itself, and in the Ceylon forms (and it is very characteristic of many) the furrows and ridges pass into a decussate surface (Plate LXXXVI. fig. 7), the latter breaking up into papillate eminences, sometimes distant, more often close like pin-points. I cannot recall any shell with exactly this kind of sculpture on the Eastern Frontier, but several are found in Southern India.

I should much like to obtain Semper's second species, *E. layardi*, which is evidently not quite the same animal as *E. subopaca*.

Euplecta partita, Pfeiffer. (Plate LXXXVII. figs. 1–1 *e*.)

*Helix partita*, Pfeiffer, P. Z. S. 1853, p. 125; id. Mon. Hel. vol. iv. p. 55; Reeve, Conch. Icon. pl. clxxxviii. fig. 1311 (*H. subopaca*, pl. clxxxvii. fig. 1302); Hanley, Conch. Ind. p. 36, pl. lxxxv. figs. 5, 6.

*Macrochlamys* (sec. A) *partita*, Theob. Supp. Cat. p. 18.

*Nanina partita*, Nevill, Hand-list, p. 28, =*subopaca*, Reeve.

*Macrochlamys partita*, Clessin, Nomen. Helic. 1881, p. 44, =*subopaca*.

=*H. marcida*, Bs.? non Shuttl.

*Nanina partita*, Tryon, Man. Conch. 1886, vol. ii. pl. xxxii. figs. 25, 26; *subopaca*, fig. 27.

Original description (=*H. marcida*, Bens.? non Shuttl.):—

"H. *testa perforata, convexo-depressa, solidula, superne confertissime et inæqualiter subarcuato-costulata, sericina, fulvo-cornea; spira magis minusve elevata, vertice subtili, prominulo; sutura levi; anfractibus* $5\frac{1}{2}$, *convexiusculis, sensim accrescentibus, ultimo vix latiore, non descendente, basi læviusculo, suplanulato; apertura parum obliqua, lunari; peristomate simplice, recto, marginibus vix convergentibus, columellari declivi, ad perforationem subincrassato, reflexiusculo.*

"Diam. maj. 13, min. $11\frac{1}{2}$, alt. 7 mill.

"*β. major tenuior, pallide cornea.*

"Diam. maj. 15, min. 13, alt. $7\frac{2}{3}$ mill.

* Since writing this, *vidua* has come to hand, and is described further on in this Part.

'*Hab.* in insula Ceylon (*Layard*; *β*, *Thwaites*).

"Differt ab *H. subopaca.* Sculptura subtiliore, minus regulari, anfractu ultimo minus dilatato, &c."

Original description (*Helix subopaca*, Pfr.):—"H. *testa semiobtecte perforata, conoideo-depressa, solidula, superne subarcuatim costulata, basi radiato-striata, subopaca, pallide rubello-cornea; spira breviter conoidea; sutura simplex, impressa; anfractibus* 6½, *vix convexiusculis, ultimo non descendente, basi planiusculo; apertura obliqua, lunari, intus margaritacea; peristomate simplice, recto, margine columellari declivi, subincrassato, ad perforationem triangulatim dilatato.*

"Diam. maj. 17, min. 14½, alt. 9 mill.

"*Hab.* in insula Ceylon."

The specimen dissected was obtained at Ambagamuwa (*O. Collett*). Collett says in his paper on the shells of this district:—"This is one of our commonest species. It is rather variable in size and in depth of colour. The animal, which is black and white, is dimly visible through the shell. Habitat amongst leaf-mould around the roots of plants."

*Generative organs.* The lower main sheath of the male organ (Plate LXXXVII. figs. 1–1 *b*) is very short, from the generative aperture upwards; it then diminishes in section and is folded into a large loop confined by a strong broad muscle. Near the return portion of the free loop is a short stout portion, the muscular diverticulum or cæcum, to which is attached the retractor muscle. Near the same place is the short kalk-sac, and to this the vas deferens joins (figs. 1 *b*, 1 *c*). In this specimen at this junction a very remarkable set of finger-like processes, one overlying the other, was very conspicuous, denoting the formation of the spermatophore, in this respect differing very much from other species.

The spermatheca is globose and short. The amatorial organ well developed. There is neither a right shell-lobe nor a left shell-lobe. The left dorsal lobe is divided into a large anterior and a small elongate narrow posterior portion.

The formula of the radula is:—

$$\frac{72 \,.\, 1 \,.\, 13 \,.\, 1 \,.\, 13 \,.\, 1 \,.\, 72}{86 \,.\, 1 \,.\, 86}$$

The central tooth is tricuspid, narrow, elongate, with small cusps; the median teeth are tricuspid, the inner cusp indicated by a slight notch on the inner side; the laterals are long, curved, and bicuspid, the outer cusp considerably below the point of the inner.

This agrees in every respect with Semper's description of the radula of *subopaca*, but he gives the number of teeth in the row as less; this is not important: it sometimes happens that the edge of the radula is incomplete, and the very minute teeth are not counted; therefore the number of the broad median teeth, and the 2 or 3 transition teeth, is of much more importance.

Euplecta præeminens, E. R. Sykes. (Plate LXXXVI. figs. 1–7.)

Sykes, Proc. Malacol. Soc. vol. iii. no. 2, p. 71, July 1898, pl. v. figs. 5, 6 (shell).

Original description :—" *Testa subperforata, depresso-conoidea, tenuiuscula, superne confertim costulata, lineis impressis spiralibus regulariter granulata, corneo-brunnea, versus apicem lineis spiralibus validioribus quam costulis sculpta; spira concava, apice elevato, acuto; anfr.* 6–6½, *plano-convexi, mediocriter accrescentes, ultimus non descendens, acute carinatus, basi convexus, radiatim striatulus, nitidus; apertura obliqua, angulato-lunaris; peristoma simplex, rectum, margine columellari ad perforationem subreflexo.*

" Alt. 15 : diam. max. 25·5 mill.

" *Hab.* Watawala, Ceylon (*Collett*).

"This is the *Helix acuducta*, Benson, of Mr. Collett, in his interesting paper * on the land-shells of Ambagamuwa. From an examination of Benson's specimen, preserved at Cambridge, which agrees fairly well with his original description, I arrive at the following differences :—*H. acuducta* is slightly lighter in colour, *does not possess the drawn-out apex*, the whorls do not increase so rapidly, the sculpture is not so strong, the protoconch is nearly smooth, and only shows the spiral lines very indistinctly. To sum up, the true *H. acuducta* is a shell in form, etc., rather of the group of *E isabellina*, Pfr., and *E. colletti*, Sykes.

"The shell figured in the Conch. Ind. (pl. l. fig. 5) is very probably the present species. Another specimen, measured in a similar manner, gives alt. 14·5, diam. max. ·25 mm.; it is slightly darker, and the spiral lines being weaker, does not appear so granular: this smaller shell is the one figured, the larger specimen having met with an accident."

*Animal* (Plate LXXXVI. fig. 1), from the Binoya Estate (*Collett*). There is a minute right shell-lobe (fig. 2), but no left shell-lobe. The right dorsal lobe is moderately large, the left is in two distinct parts, the posterior lobe long and narrow.

The jaw (fig. 5) has a central projection on a strongly concave edge. The arrangement of teeth in the row is :—

$$\frac{54 \;.\; 1 \;.\; 21 \;.\; 1 \;.\; 21 \;.\; 1 \;.\; 54}{76 \;.\; 1 \;.\; 76}$$

Central (figs. 6–6 *b*) with a long point; median with cusp on outer side; laterals, outer point below the inner.

The generative organs (figs. 4–4 *c*) are interesting.

The penis-sheath is doubled back into a loop, which is held together by a very muscular band; it then gives off a branch to the retractor muscle and to another twisted short portion the vas deferens is united. When the band of muscle is severed across and the whole extended from the retractor muscle, it has an

* Journ. Roy. As. Soc. (Ceylon Branch), vol. xv.

elongated simple form with no flagellum. All this arrangement and proportion of the parts to one another in the male organ differs much from what is seen in *Macrochlamys*, and even in *Ariophanta* and *Nilgiria*. The mucous pore is large (fig. 3), extending to the sole of the foot, which is undivided. In this last respect there is considerable modification of structure.

EUPLECTA SEMIDECUSSATA, Pfr. (Plate XCVII. figs. 2–2 *d*.)

*Helix semidecussata*, Pfr. P. Z. S. 1851, p. 252; Küst. ed. Chemn. ii. no. 955, t. 145. figs. 8, 9; Pfr. Mon. Hel. vol. iii. p. 53; Reeve, Conch. Icon. cii. fig. 567 (very good figure); Hanley, Conch. Ind. p. 27, pl. lviii. fig. 1; O. Collett, Journ. R. Asiat. Soc. (Ceyl. Br.), vol. xv. p. 3 (1897).

*Helix semidecussata*, var. *solida*, Bs., Hanley, Conch. Ind. p. 27, pl. lviii. fig. 2.

*Hemiplecta semidecussata*, Clessin, Nomen. Helic. 1881, p. 50.

*Rotula* (sec. A) *semidecussata*, Theob. Supp. Cat. p. 21; wrong plate is quoted.

*Nanina semidecussata*, Nevill, Hand-list, p. 29.

*Hab.* Ambagamuwa, Ceylon (*O. Collett*).

Evidently two different species are figured in the 'Conch. Indica,' one with a raised keel belonging to the genus *Euplecta*, the other has no sign of it.

Nevill says, in his MS. copy of 'Hand-list,' there is a closely allied species from Madagascar; and Hanley says, essentially identical with the Mauritian species. Whether the animal will prove to be so is an interesting point to be ascertained.

Original description:—"H. *testâ perforatâ, conoideâ, solidâ, supernè minutè decussatâ, opacâ, unicolore rufo-fuscâ; spirâ conoideâ, acutiusculâ; anfractibus* 7, *vix convexiusculis, ultimo carinato, non descendente, basi convexo; apertura diagonali, angulato-lunari; peristomate simplice, recto, obtuso, margine columellari supernè brevissimè reflexiusculo.*

"Diam. maj. 33, min. 30, alt. 18 mill.

"*Hab.* in insula Mauritii."

Collett writes*:—"I have found this species fairly common throughout the district. It occurs among fallen leaves in forest and scrub, and is much preyed upon by birds, with whom it appears to be a favourite food. I have occasionally come across a sacrificial stone in the jungle surrounded by heaps of broken shells. When alive, the animal, which is mottled black and white, gives a handsome 'checked' appearance to the reddish-brown translucent shell. The body-whorl of young specimens is acutely angular."

This black and white mottling is not on the foot of the animal, but on the integument covering the branchial chamber.

The specimen now described was obtained on the Binoya Estate (*Collett*).

* Journ. Roy. As. Soc. (Ceylon Branch), vol. xv.: "Contributions to Ceylon Malacology."

*Animal.* Sole of the foot not divided, in spirit it is folded on the central line, and under a lens has a similar surface to *Ratnadvipia irradians.*

In the odontophore the arrangement of the teeth is as follows :—

82 . 2 . 19 . 1 . 19 . 2 . 82
103 . 1 . 103

The central tooth has a single cusp on both sides ; the median teeth have a single cusp on the outer side up to the 13th and 14th, when a small notch is seen near the apex on the inner side, and becomes larger and situated lower down as it approaches the 19th tooth. The laterals are all evenly bicuspid. The jaw has a very slight central projection. Mantle as in previously described species of this genus. There is a minute rudiment of the right shell-lobe ; the left dorsal lobe is in two parts, the anterior very close to the posterior. The male organ has a large loop formed by strong connecting muscle a short distance above the generative aperture, attaching the lower part of the muscular cæcum at that point. The spermatheca is short and globose. Just above it, at the posterior portion of the vagina, is a globose swelling having a regular folded surface, remarkably well developed, the true function of which requires investigation. A similar protuberance, but not exactly of the same size and shape, may be seen in some other South Indian species, such as *Ariophanta lævipes* (Plate LXXX. figs. 5, 5 *a*), *Euplecta partita* (Plate LXXXVII. fig. 1), *Mariælla dussumieri* (Plate XCIII. fig. 1 *a*), and *Nilgiria ligulata* (Plate XCVIII. fig. 1 *c*, *ot*). In the same part of the genitalia I have noticed a similar enlargement in one specimen of *Nilgiria tranquebarica*—probably it varies in size with the general seasonal growth of these organs. This I dissected out (Plate XCVIII. figs. 2, 2 *a*), and on laying open the duct of the vagina lower down and below the swelling of the duct, it is seen to have a rugose lining, and that these rugæ within the expanded sac become largely developed so as to almost completely occupy the interior of it. I can only suppose that this elaborate constriction may be a provision for keeping back the ova before contact with the spermatozoa, and we may term this portion the "*ovitheca*"; they would further develop here, and pass out gradually : or may it indicate a stage in development after the fertilization of the ova, a stage which is carried still further in some species by a long period of embryonic growth, including development of the shell, resulting in ovo-viviparous reproduction ?

EUPLECTA SHIPLAYI ?, Pfr.

*Helix shiplayi*, Pfr. P. Z. S. 1856, p. 327 ; id. Mon. Hel. vol. iv. p. 39 ; Hanley, Conch. Ind. p. 53, pl. cxxxi. figs. 7, 10 (Beypur, Anamullay Hills).

*Rotula shiplayi*, Theobald, Supp. Cat. p. 21.

*Nanina shiplayi*, W. Blf. J. A. S. B. p. 39 (1866) ; Nevill, Hand-list, p. 31 (Koonoor Ghat, Pulney Hills, and S. Canara).

*Hemiplecta shiplayi*, Clessin, Nomen. Helic. p. 50.

Original description :—" *Testa perforata, subturbinata, solidula, superne arcuato-plicata, striisque spiralibus eleganter granulata, isabellina; spira convexiusculo-conica, obtusula; sutura subcanaliculata; anfr.* 6, *convexi, lente accrescentes, ultimus peripheria carina acuta, compressa, antice evanescente munitus, basi convexus, lævior; apertura diagonalis, subangulato-lunaris, intus margaritacea; perist. simplex, obtusulum, margine columellari fere verticali, superne triangulatim reflexo.*

" Diam. maj. 20, min. 18, alt. $11\frac{1}{2}$ mill. (*Mus. Cuming*).

" Habitat in montibus Nilagiricis Indiæ (*Conway Shiplay*)."

The animal which I refer with doubt to this species came from the Kadur District, Mysore (*Mr. W. M. Daly*). It is not fully grown, but agrees with the description in the Mon. Helic. Vivent. The sculpture consists of plicate transverse ridges, on which are set about 15 papillate eminences, forming the same number of regular spiral lines. These are strongest near the periphery. This Mysore specimen is not so high in the spire as shown in the figure in the 'Conch. Indica.'

Size: diam. maj. 14, min. 12; alt. axis 6·25 mm.

Mr. W. T. Blanford wrote in 1866 as follows:—" *N. shiplayi*, Pfr., inhabits the eastern base of both the Anamullays and the Nilgiris; on the latter hills I have found it at the foot of the Coonoor Ghat. The animal is a *Nanina*, closely resembling *N. indica*, Pfr., and *N. acuducta*, Bens., having a large mucous pore at the caudal extremity of the foot without an overhanging lobe, or with but a rudimentary one. The mantle-lobes are small, and the animal in all respects closely resembles that of the subgenus *Ariophanta*."

*H. indica*, Pfr., no doubt should be put in *Euplecta*, so also should *H. gardneri*, Pfr.

*Animal.* An indistinct medial area on sole of foot; the right shell-lobe is very minute, no left shell-lobe; left dorsal lobe in two parts, similar to that of *E. præeminens*.

Teeth of radula arranged:—

50 . 3 . 12 . 1 . 12 . 3 . 50
65 . 1 . 65

Laterals bicuspid.

EUPLECTA BINOYAENSIS, n. sp. (Plate XCVII. figs. 1–1 *d*.)

*Locality.* Ambagamuwa, Ceylon (*O. Collett*).

Shell globosely conoid, very convex below, keeled sharply with a lirate edge, continued at the suture; sculpture evenly ribbed, the ribs set with minute papillæ in regular spiral lines (fig. 1 *a*, ×58), smooth and shiny below, no spiral striæ; colour pale sienna-brown, grey on the apex; spire depressedly conoid, apex rather blunt; suture well marked; whorls 5, increasing gradually; aperture broadly lunate; peristome thin; columellar margin scarcely reflected, weak.

Size: maj. diam. 10, min. 9·8; alt. axis 5·6 mm.

Note by Mr. Collett: "From among ferns in a swamp." Binoya Estate, 3600 ft.

*Generative organs* as in the genus. The muscular cæcum (*crp*) is short, and so is the loop below it. In this specimen a spermatophore in process of formation was discovered (Plate XCVII. figs. 1 *b*, 1 *c*) and is noticeable, in form quite unlike those of the Macrochlamidæ. It consists of a large elongate conoid mass set on one side with minute spines at the base, these becoming in succession larger above; here and near where the vas deferens unites with the penis is the thin capsule, also spined down one side, the spines being bifid and arranged in sets of two together. This may be compared with the figures of the spermatophore of *Nilgiria tranquebarica* on Plate XCIV. figs. 5–5 *e*, where, it may be seen, the normal position near the junction of the vas deferens is the same.

The full breadth of the radula was not seen, the outermost teeth having been lost.

$$+40 \;.\; 2 \;.\; 12 \;.\; 1 \;.\; 12 \;.\; 2 \;.\; 40+$$
$$+54 \;.\; 1 \;.\; 54+$$

The teeth are similar in shape to those of other species of the genus.

This shell is not fully grown, but it is nearly so, as shown by the advanced stage of development of the spermatophore. And this opens up another line of inquiry. At what stage in their growth do they unite in reproduction? I have had, therefore, some hesitation in naming it. I referred it to Mr. Sykes, who has been lately studying Ceylon shells; he writes:—"I cannot quite name this, it runs very near to several of the *Euplecta* group." It may turn out to be the young of some well-known Ceylon species. I trust Mr. Collett will endeavour to procure a series of species of *Euplecta* in all stages of growth. Mr. E. R. Sykes has described and figured one under the title *E. colletti* *; a close ally of this is *Euplecta isabellina*, Pfr., fig. 7 of same plate. There is yet another, *E. scobinoides*, described and figured, figs. 1, 2. All three species are sharply-keeled forms.

Among Ceylon shells the following species may be expected to belong to this subgenus: *gardneri*, *subconoidea*, *isabellina*, *emiliana=cingalensis*, *novella*, *albizonata*, &c. In Southern India: *travancorica*, *koondaensis*, and *subdecussata*. The animals of all these and some other species require to be examined.

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## Subgenus Girasia.

(*Continued from* p. 228, Vol. 1.)

Girasia hookeri, Gray (type), and its varieties, *vide* pp. 219 & 220, Vol. I. (Plate LXXXVIII.)

The drawings of the spermatophore referred to in the P. Z. S. 1880, pl. xxvii. figs. 8–8 *b*, I now reproduce on Plate LXXXVIII.

* Proc. Malacol. Soc. vol. ii. no. 5, July 1897, p. 234, pl. xvi. figs. 5, 6.

figs. 1, 1 *a*, 1 *b*. Further observation of these structures shows that the position of the cervicorn processes, and those more feathery and elongate, is well-defined: the latter are attached at the base of the "flume" or gutter (Plate XCIII. figs. 1 *b*, 1 *c*); the former at the head, where the sac or capsule is situated. In *Girasia* the sides of the flume are straight, and the short spines set at close intervals, which are seen in other genera, are absent. I give also a copy (on Plate LXXXVIII. fig. 1 *c*) of fig. 5, pl. xxvii. P. Z. S. 1880, representing the segmentation of the foot in this genus, and which is described on p. 219, Vol. I. of this work. This segmentation appears to be structural, not due to muscular contraction, which would be less regular; these segments across the sole of the foot correspond to, and are continuous with, the main segments of the pallial fringe or margin of the foot. Having lately dissected specimens of *G. hookeri*, I am able to supplement my previous description in Vol. I. by further details. When the shell-lobes are cut and laid back and the shell removed, the visceral sac presents no coil whatever (see Plate LXXXVIII. fig. 2 *e*), a character to be noted when this genus is compared with *Damayantia*, *Parmarion*, and *Microparmarion* of the Malay Archipelago (see Plates LXXIII.–LXXV., Part VIII.), or with *Africarion* of S. Peninsular India (Plate LVII., Part VI.). On the left side of the visceral sac two close parallel lines may be traced, which correspond to a narrow raised ridge on the outside of the mantle, more or less conspicuous in life (*vide* Plate LX.); this occupies a position more analogous to the keel of the shell, for it is not related to the line of division between the shell- and mantle-lobes, beyond running somewhat parallel with it, but inside it.

As the position of the main muscle-attachments is an interesting point in the anatomy of the slug-like species, I have paid attention to it; no part of their structure can be overlooked, for all becomes valuable from a morphological point of view. Simroth, Pilsbry and Vanatta have shown this. It is well to quote a paragraph in a paper by the two latter named naturalists ("A Revision of the North-American Slugs") * :—

"That 'system' is, in fact, an epitome of the total structure, as well as, with certain distortions, a phylogeny of organisms; we have freely used characters from all organs in which we found differentiation, in the construction of our scheme of family, subfamily, and generic classification."

As exposed to view on dissection, the dart occupies the right-hand side of the animal; the penis is on the top of the neck. The main body-cavity does not extend back into the foot; there is a distinct separation between this and another cavity on a plane below the periphery of the shell, Plate LXXXVIII. figs. 2 *a*, 2 *b*. The upper or visceral cavity is again divided diagonally into anterior and posterior chambers. The former is the branchial cavity with the heart and renal organ; the latter is occupied by the intestinal folds

* Proc. Acad. Nat. Sciences of Philadelphia, 1898, p. 219.

and liver-lobes (*l*) (figs. 2 *a*, 2 *f*), the albumen-gland, hermaphrodite-glands, and duct. Through the diaphragm and attached to it, and lying on the right-hand side, pass the intestine behind and the genitalia in front, a short distance the one from the other.

The principal retractor muscles have their attachments on the roof of the main body-cavity, which is represented viewed from below in figs. 2 *c* and 2 *b*, from the right side in fig. 2 *a*. The largest and strongest is that of the buccal mass; it occupies a central position, the point of attachment being close to where the uterus and oviduct pass through the diaphragm into the visceral chamber, and on the strong muscular diagonal division of that chamber. The retractor muscle of the left eye-tentacle is given off from it lower down, while that of the right eye-tentacle is a bifurcation in a similar way with that of the penis retractor. The attachment of this is also central and immediately behind the buccal retractor. About the middle of its length, the buccal retractor muscle is attached to the upper surface of the stomach (fig. 2 *g*), a beautiful adaptation, allowing this and the salivary glands to retain their relative position with the movements of the animal. Another set of muscles of the buccal mass have their attachments on the side or dorsal position. Two of these, which I name the right and left dorsal muscles of the buccal mass, have their attachment points forward on the diaphragm, and one central dorsal muscle on the integument of the neck; and one is on the left side of the diaphragm opposite its perforation by the intestine (fig. 2 *b*). The retractor muscle of the dart (D) holds the most posterior position of all, centrally at the back of the body-cavity. One long and three shorter very strong muscles are attached to the lower floor of the body-cavity (B*p*, fig. 2 *d*) and are connected with the underside of the buccal mass. On the side of the foot some short isolated muscles are attached to the same floor and in connection with the nervous ganglia. All form a most beautifully balanced and constructed system of nervous tendons, pulling and contracting one against the other in every direction. There are many other minor sets closer to the buccal mass or attached to the sides and floor of the body-cavity, and some that are attached to the amatorial organ (*vide* Plate LXXXV. figs. 6, 6 *b*).

The intestine (*i*) on entering the visceral cavity (fig. 2 *f*), enfolded by the liver-lobes, occupies the posterior portion. The albumen-gland (*Al.gd*) is situated close to its entrance, the hermaphrodite-duct running backward to the extreme hinder part of the cavity, the hermaphrodite-glands being embedded in the liver-lobe which occupies this position also. The intestine forms a reversed **S**-like loop forward, returns backward, then expands into a globose form, and contracting again forward passes to the anus. The pulmonary cavity is forward, in direct and short connection with the respiratory orifice: the auricle and ventricle are also in this forward position, the renal organ of oval form being above it. Above all the thin membranaceous long spatulate shell covers the integument of the visceral mass.

The *virgula amatoria* in the centre of the amatorial organ is very short and blunt (fig. 2 *h*). The posterior end of the male organ (fig. 2 *i*), where it is bent on itself, is simple and rounded, with no sign of diverticulum or cæcum-like appendages as is seen in typical *Macrochlamys*.

GIRASIA SHANENSIS, n. sp. (Plate XCI. figs. 3-3 *e*.)

*Locality*. Shan Hills, east of Fort Stedman (*Colonel Woodthorpe, R.E., C.B.*).

In 'Land and Freshwater Mollusca of India,' Part VI. p. 237, Plate LIX. Vol. I., I figured the shell of *Austenia ? venusta*, Theobald. In 1893 my friend Col. Woodthorpe, when surveying the Burmese-Siam frontier, sent me from the Shan country specimens preserved in spirit of a closely allied species; I thought at first it was the same. Mr. Theobald did not describe the animal; it was therefore interesting to get this specimen, badly preserved as it was. A closer examination shows that the shell is not altogether the same in the proportion of the apex to the rest of the spatulate body-whorl. The same differences exist on comparing it with *G. peguensis*.

Shell (figs. 3, 3 *a*) flattened above, of oval outline on the periphery; viewed from below it is scoop-shaped. The apex, consisting of one whorl, is very small, much smaller than in either of the allied forms, *G. peguensis* or *G. venusta*. Colour strong ochre; surface quite smooth and polished; grey within.

*Animal* (in spirit) (fig. 3 *b*). Dark grey throughout, the extremity of foot with a long lineal mucous pore: the specimen was badly preserved; the left shell-lobe was seen to be long and narrow. In figure 3 *b* the visceral sac and mantle-covering had been destroyed and is left blank, but it shows that the animal is similar in form and proportion to *G. peguensis*.

*Odontophore*. The median teeth bicuspid, the outer cusp being far below the apical, as in *Austenia gigas*, &c.; the outermost lateral teeth are small and unicuspid.

The generative organs were not in a state to describe from, but two spermatophores (fig. 3 *c*) were perfect and were precisely similar to those of *Girasia*, which will be referred to in this Part and compared with those of other genera.

In the descriptions of the genera *Girasia* and *Austenia*, which were published in Vol. I. pp. 148 & 226, and following pages respectively, I referred to the anatomy of this group of shells as described and figured in the P. Z. S. 1880, p. 289. As this paper had then only recently been published by me, I did not reproduce the plates, but now, in order to bring together in this work all the anatomical details of these genera up to the present examined, I think, for purposes of comparison, it is desirable to do so, and at the same time keep those of the different species separate. In the above paper much confusion may be caused by my having figured together parts of three different specimens, viz.: (1) *Austenia gigas* from the

typical locality, Teria Ghat; (2) a small variety from the Khasi plateau; and (3) one from the Naga Hills, considered at first to be identical, but distinguished as *gigas*, var. *minor*, which I afterwards named *A. butleri*, G.-A.

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### Subgenus Austenia.

(*Continued from* Vol. I. p. 238.)

On Plate XC. will be found the anatomy of the Naga species, *A. butleri*, G.-A.

On Plate LXXXIX. that of the Khasi Hill *A. gigas*.

The Naga Hill species must be placed in *Austenia*, not as I have it on p. 226 (Vol. I.) in *Girasia*; further correction is necessary on p. 226, 12th line from the bottom, where Plate XXV. figs. 1–5 should be omitted, and the addition made of Plate XXIV. fig. 9 (shell) and Plate XXVI. figs. 5 & 8 (generative organs).

Austenia gurhwalensis, n. sp. (Plate XCI. figs. 1–1 *h*).

*Locality*. Paurhi, Gurhwal (*Lt. F. Howard, R.E.*).

Shell depressedly conoid, thin; periphery ovate, very narrowly umbilicated, pellucid; sculpture (fig. 1 *b*) strong transverse ridges of growth, with fine regular chiselled longitudinal striæ, 35=0·01 inch; colour olivaceous brown; spire depressed; apex rounded; suture shallow; whorls 4, evenly increasing, rounded on the periphery; aperture oblique, ovately lunate; peristome thin, rounded below, from the columellar margin.

Size: maj. diam. 21·75, min. 17·0; alt. axis 8·0; alt. body-whorl 9·25 mm.

This species differs much from all others hitherto obtained in the N.W. Himalaya in its beautifully sculptured surface (fig. 1 *b*); in form it may be distinguished from *A. monticola* by the larger apex, less closely wound, and its more oval shape.

Owing to the decayed state of the specimen, only a portion of the anatomy could be noted. It possesses a thick amatorial organ (fig. 1 *h*), pointed at the retractor muscle end and considerably twisted*. The radula (figs. 1 *d*–1 *g*) is like that of *gigas*. Central tooth with strong cusps on either side, the median with only one on the outer side; up to the 22nd, 23rd, and the 24th are transitional in form, and all the lateral are bicuspid, with one long point, the second being some way below it on the outer side; a few of the outermost teeth (fig. 1 *g*) are minute and unicuspid. The jaw (fig. 1 *c*) is strongly formed, concave, with a large central projection.

* I generally describe the form of all these internal organs as they appear on dissection. In truth very little importance can be attached to twisting, or to the sharp bends many parts assume, owing to the natural spiral character of the visceral mass. On protrusion in life, all organs assume a very different straighter appearance, which can be allowed for.

Austenia paurhiensis, n. sp. (Plate XCI. figs. 2–2 *c*).

*Locality.* Paurhi, Gurhwal (*Lt. F. Howard, R.E.*).

Shell depressedly globose, not umbilicated; sculpture quite smooth, with irregular furrows of growth; colour ochraceous, with a slight green tint; spire depressed; apex scarcely raised; suture very shallow; whorls 4, tumid, the last rapidly increasing, rounded on the periphery; aperture nearly circular, oblique; peristome very thin; columellar margin very weak, slightly reflected above.

Size: maj. diam. 13·0, min. 10·5; alt. axis 5 mm.

I have compared this with specimens in my collection; the shape is more globose and the aperture more circular than any of them. Some six specimens were sent home which had been put in salt and then in spirit, and although not in the best order, have been useful as giving the following details of the anatomy:—

The animal (figs. 2 *b*, 2 *c*) measures 12 mm. long. Sole of foot with a central area, the sides distantly segmented. Colour greyish ochre. The dorsal shell-lobes are sparsely spotted black. The right shell-lobe has a pinkish tint, is broad from the respiratory orifice, and narrowing below and posteriorly at the back of the shell and joins the left shell-lobe there; this last is a narrow reflected band from the respiratory orifice, widening gradually, and on the left margin gives off a triangular retractile tongue-shaped process, also of a pinkish tint. Right dorsal lobe is small, the left long and broad, of nearly equal breadth throughout.

The generative organs were not at their full stage of development. The amatorial organ was large and cylindrical, with a bluntly pointed end.

The odontophore was similar to *A. gurhwalensis* in form of the teeth.

36 . 2 . 15 . 1 . 15 . 2 . 36
53 . 1 . 53

Jaw with a central projection.

Specimens from the N.W. Himalaya of *A. monticola*, in perfect preservation, are still needed before splitting this group of *Ibycus* and *Austenia* still further, as proposed by Mr. T. D. A. Cockerell in 'The Nautilus,' vol. xii. no. 1, p. 10 (May 1898).

In continuation of the remarks on *Austenia planospira*, p. 93, this species must be removed from this subgenus and placed for the present in *Eurychlamys*. The amatorial organ, of which I give a drawing, Pl. XCI. fig. 4, is the chief difference to be found. The same extent of differentiation as I have shown on p. 69, Vol. II., occurs in the genus *Durgella*.

## Microcystina.

(*Continued from* Vol. I. p. 14.)

Microcystina perfucata, Benson. (Plate XCII. fig. 4.)

*Helix perfucata*, Bens. A. M. N. H. 1853, xii. p. 93 ; Pfr. Mon. Hel. vol. iv. p. 50 ; Hanley, Conch. Ind. p. viii (not figured).
*Hemiplecta* (sec. C) *perfucata*, Theob. Supp. Cat. p. 22.
*Microcystis perfucata*, Clessin, Nomen. Helic. p. 37.

Original description:—"*Testa vix perforata, depressa, translucen, purpureo-fusca, politissima, spira elevatiuscula, sutura submarginata, apice obtuso; anfractibus 4, convexiusculis, arcte convolutis, ultimo rotundato, subtus convexo; apertura lunata, vix obliqua; peristomate recto, acuto, margine columellari verticali, leviter reflexo, umbilico non pervio.*
"Diam. maj. 5, min. 4, axis 3 mill.
"*Hab.* in pago Gallensi, inter saxa.
"Remarkable for its deep clear purple-brown colour."

Microcystina perfucata, var. bintennensis. (Plate XCII. figs. 3–3 *i*.)

Bintenne, Ceylon (*Collett*).
The sculpture is fine and longitudinal, 14 = 0·50 inch.
*Animal.* The mucous gland is linear, the extremity of foot square, the end above the gland projecting over it. Pallial margin broad. The sole of foot divided. There is a right shell-lobe, no left shell-lobe; the left dorsal lobe is in two separate flaps.
The jaw has a large central projection.
The teeth of the radula are arranged thus:—

30 . 1 . 8 . 1 . 8 . 1 . 30
39 . 1 . 39

This formula agrees very well with that of *M. rinkii*, Mörch (Vol. I. p. 11), of the Andaman Islands.
The male organ was in good preservation. It presents a simple straight sheath, tapering above to the retractor muscle. The vas deferens appears to join it just below this point, but it really does so at the side much lower down. This is indistinctly shown in fig. 3 *g*, but on placing the object between two glass slips, and with light pressure, it was very clearly seen. The rest of the genitalia was not made out. The buccal mass has a very strong basal muscle; the salivary gland is a globose mass.
Although the columellar margin in these Ceylon species is not exactly of the same form as in typical *Microcystina* of the Andamans, I have no hesitation in placing them together, there being so many other more important characters common to both. The radula is the same in number and form of the teeth, both have a right shell-lobe and no amatorial organ, and the type of sculpture is the same.

A species received from Mr. E. R. Sykes, collected by Mr. O. Collett at Dumballa, Ceylon, agrees in every respect, the umbilicus only being slightly less open than in the Bintenne specimens.

Thanks to Mr. Sykes I have been able to see and draw a species lately described by him as *Microcystina lita*; this has enabled me to identify as the young a minute shell taken during the rainy season off the bark of a mango-tree by Mrs. Collett, of which some specimens were sent; and from off the same tree among the moss I found a little *Pupisoma* (?), and another very interesting new species I describe further on. The immature shell of *M. lita* I figure on Plate XCII. (figs. 2–2 *c*), which can be compared with similar parts of the adult shell.

Microcystina lita, E. R. Sykes. (Plate XCII. figs. 1–1 *c*).

Sykes, Proc. Malacol. Soc. of London, vol. iii. July 1898, p. 70, pl. v. figs. 10, 11.

Original description :—" *Testa* [fig. 1] *subperforata, globose-conica, tenuis, polita, nitidissima; sutura bene impressa; anfr.* 5, *lente accrescentes, brunnei, primus pallidior, fere lævis, reliqui microscopice undique dense spiraliter striati et lineis incrementibus remotis sculpti* [fig. 1 *a*], *ultimus rotundatus; apertura lunata, margine columellari* [fig. 1 *c*] *subreflexo, incrassatulo.*

" Alt. 3·4, lat. 2 mill.

" *Hab.* Ambagamuwa (*Collett*).

" Lieut.-Col. Godwin-Austen has kindly pointed out to me that the microscopic sculpture of this shell is similar to that of the *Microcystina* of the Andaman Islands, and I have thought it best to place it in that genus; though the strongly-marked notch of that group is not present, still the columella shows a trace of it. Under a microscope faint traces of spiral sculpture are also seen on the *Helix perfucata* of Benson."

Subgenus Microcystis, Beck *.

Type *M. ornatella*, Beck. Pitcairn Island.

Microcystis ? ambæ, n. sp. (Plate XCIII. figs. 3–3 *h*.)

*Locality.* Ambagamuwa, Ceylon (*O. Collett*).

Shell (figs. 3, 3 *a*) globosely pyramidal, umbilicated; sculpture (fig. 3 *b*) decussate near the apex, longitudinal ribs broken up in isolated papillæ, on the last whorl the transverse ribbing becomes the strongest, crossed by fine furrows; colour pale sienna; spire broadly pyramidal, sides slightly convex; apex blunt and rather flat; suture shallow; whorls 4, moderately convex, regularly increasing,

* This subgenus will be one of the first to be included in another part of this work. Some material has already been examined; I have a so-called *Microcystis* from Ceylon and another from the Malay Peninsula to describe in detail.

slight indication of keel, rounded near aperture; aperture roundly lunate, suboblique; peristome thin, perpendicular at the columellar margin, well reflected.

Size: maj. diam. 2·5; alt. axis 1·4 mm.

Taken off the trunk of a mango-tree in very wet weather, July 1896, together with a species of *Kaliella*.

I at first identified this shell as *K. delectabilis*, Sykes, but the sculpture is transverse and very different. (See and compare drawing of this, fig. 4.)

*Animal.* Very pale-coloured. The eyes in the spirit-specimen (apparently) on very short blunt tentacles (fig. 3 *c*); from the position of the eye, contracted, they could not be long in life. The foot is divided with a pallial line; sole of foot rounded behind and truncate, with a mucous gland apparent.

The generative organs were not in a state to be made out; no amatorial organ appeared present, nor could I, in the three specimens dissected, find the jaw.

The radula (fig. 3 *e*) is extremely small, and the form of the outer teeth very difficult to make out; they are tricuspid, like those of *Kaliella*.

$$\frac{25 \;.\; 1 \;.\; 5 \;.\; 1 \;.\; 5 \;.\; 1 \;.\; 25}{31 \;.\; 1 \;.\; 31}$$

The animal is ovo-viviparous. There were four young in the uterus (fig. 3 *f*), three with the shells well developed in two specimens I examined; these embryonic shells are 0·6 to 0·7 mm. in diameter of $1\frac{1}{2}$ whorls, and the rough decussate surface is already well seen. In this early stage of growth (fig. 3 *h*) the eyes (*e*) are conspicuous, and the foot (*f*) well developed and extruded at the aperture. In one, two tubes (*x*) were discerned close together, one larger than the other, which, from their position, would indicate the early formation of the anal and respiratory organs respectively.

Extending from both eyes backward was a long filamentary agglomeration of dark particles or pigmented cells, ending gradually in a point (*rm*), which I take to be the retractor muscles of those organs in course of development. The apical portion of the shell was filled with a large cellular mass, which would in this place correspond to the mature liver. In better-preserved specimens the gradual development of the series would be an interesting study up to the final exit of an individual able and ready to crawl about and feed itself.

I am in great doubt as to the position of this species and place it for the present in *Microcystis*. Considering the similarity of the radula to that of *Kaliella*, we should try to learn something more of the early stages of development in that genus and compare the form of the adult animal. The embryonic development is similar in this Ceylon form to the (Oahu) Sandwich Island *Microcystis? baldwini*, Ancey, which I have dissected and described for Mr. Sykes. Semper also shows that *Microcystis myops* of Basilan has a similar ovo-viviparous habit (Reis. Philipp. iii. p. 43, pl. iv. fig. 9). Physical

conditions govern and direct early development (see p. 102), where, if I am correct, an expansion of the free oviduct indicates, when nature requires it, a change of growth in the ova.

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(*Continued from* Vol. I. p. 243, subgenus *Dekhania.*)

Genus Mariæella. (See Plates LVII. & LXII.)

*Mariælla*, Gray, Cat. Pulmonata in Brit. Mus. pt. i. p. 62 (1855).
*Tennentia*, Humbert, Rev. et Mag. Zool. p. 427 (1862).
*Vega*, Westerlund, Vega-Exped. vol. i. p. 188, pl. ii. (1887).
*Dekhania*, Godwin-Austen, Land & Freshw. Moll. Ind., Pt. VI. p. 242, Pls. LVII. & LXII. (April 1888).

*Type species*:—

Mariæella dussumieri, Gray. (Plate XCIII. figs. 1–1 *c*, 2–2 *c*.)

*Mariælla dussumieri*, Gray, Cat. Pul. B. M. p. 63 (1855); Clessin, Nomen. Helic. p. 33.

Mr. Cockerell has shown *, and I think on indisputable grounds, that Mahé, the habitat assigned to it, is not the island in the Seychelles group, but the French possession on the S.W. coast of Peninsular India, near Tellicherry, about 280 miles north of Cape Comorin.

Cockerell says:—"It is tolerably evident that we have all along been making a stupid blunder about the type locality of this slug. The original specimen in the British Museum is labelled simply as 'Mahé' by Valenciennes. This must be Mahé the French colony on the south-east † coast of India, not far from the Travancore Hills, whence came *Mariælla* [*Dekhania*] *beddomei* (G.-Aust.), which is to all appearances the same animal. I had been provisionally keeping *beddomei* as a subspecies, thinking that the Seychelles type (as it was supposed to be) *dussumieri* might, when examined anatomically, show some distinctive characters. But since *dussumieri* is from Mahé, *India*, it is doubtless the same as *beddomei*, which must sink as a synonym."

Some specimens of this genus have again come into my hands through Mr. W. T. Blanford, who obtained them from Mr. Daly, of the Balur Estate, Kadar District, Mysore; and although the genus has been treated of quite lately by Mr. Wilfred M. Webb in the 'Proceedings of the Malacological Society' (vol. iii. pt. 3, p. 147, Dec. 1898), I have made a re-examination of the animal, and give drawings of it, particularly the generative organs, which I did not give in 1888, with some remarks on other parts of the anatomy not referred to by Mr. Webb.

The largest animal measured 50 mm. in spirit, was of a very strong

* 'The Nautilus,' vol. xii. no. 1, p. 9 (May 1898).
† A mistake for south-west.

blue-black colour, and had the side of the foot smoothly papillate (above the longitudinal pallial grooves, which are not so well seen as in the ochraceous paler-coloured and smaller specimens).

One of these measured 30 mm.; the smallest 17 mm., was olivaceous in colour and unspotted.

In my original description of the animal I did not allude to one external character, and that is the narrow raised ridge on the shell-lobes which runs from the little shell-aperture round the left margin of the shell and towards the respiratory orifice on the right margin. Similar ridges are seen in *Girasia*; they shrink away if the animal is subjected to dry conditions, as in captivity.

As I said before (Vol. I. p. 242), the genitalia (Plate XCIII. fig. 1 *a*) are very similar to *Girasia*, but the amatorial organ is much smaller both in length and diameter as compared with the organs as a whole or with that of *Girasia*. The spermatheca in the example dissected and figured is very large, showing the expansible nature of the enveloping membrane. There is also an expanded bag-like portion of the uterus (*ovt*) just below the point where the vas deferens is given off; this is not seen in *Girasia*. In this specimen the spermatheca contained no less than twenty-two spermatophores whole, and the broken parts of three or four others—a far greater number than I have ever counted in any species before. They are of the usual form (figs. 1 *b*, 1 *c*), and like that of *Girasia*, the edges of the gutter (from *a* to *b*) being spineless. Short strong spines occur at the base of the capsule, and long delicate ones at the anterior end of the gutter-like portion or flume. Mr. Webb has not understood the true form of this apparatus, and has united together detached portions of several spermatophores in the figure, no. 6, pl. ix.

The shell differs from that of *M. beddomei*, which is figured on Plate LXII., in being thin, membranaceous, and transparent on the margin, while the latter is solid and shelly. Fig. 1, Plate XCIII., is the shell of the large black specimen, and is quadrate in form. Figs. 2 *b*, 2 *c* is that of the more olivaceous-green specimen, in which the apex is larger and the shell narrower and longer. These shells are similar (thin in texture) to the typical shell in the British Museum, *M. dussumieri*.

The radula (black specimen) had the formula—

88 . 3 . 20 . 1 . 20 . 3* . 88
111 . 1 . 111

a less number than in *M. beddomei*.

Another specimen:—

95 . 2 . 18 . 1 . 18 . 2* . 95
115 . 1 . 115

* There is often a doubt in counting these intermediate teeth, whether to include one or more of them in the median or laterals, they change so very gradually in their form. The proportion in breadth of the median band of teeth, on large plates, to the breadth of the narrow-plated, feeble laterals, is the important point, and in the above formulæ would perhaps be better shown thus: 88 . 47 . 88; 95 . 41 . 95, respectively.

Having recently looked at the position of the retractor muscles in *Girasia* (*vide* Plate LXXXVIII.), I examined the same in *Mariælla*: I found the retractor muscle of the amatorial organ to have its attachment under the posterior margin of the shell-cavity; the similar muscle of the penis is close to where the intestine passes through the diaphragm, that of the buccal mass where the genital organs pass through the same; thus they are comformable in the two genera. In life the amatorial organ lies on the right side of the animal alongside the capacious spermatheca. There is no doubt *Mariælla* is the South-Indian representative of *Girasia*, and may probably, in a far-distant time, have extended through the intermediate country.

Mr. Blanford has sent me the tinted drawing of a slug made by him at Mahableshwar, about 80 miles from Bombay, which I feel sure belongs to the same genus. It is grey in colour and blotched; the raised narrow ridges are well shown on the mantle. The animal if drawn to scale is 44 mm. in length. If I am right in my identification this carries the range of *Mariælla* 500 miles further north, and in all probability is another species, which I would distinguish as *M. blanfordi*, after its discoverer; and I trust before long specimens may be sent home from this part of Southern India.

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## Subgenus Bensonia.

(*Continued from* Vol. I. p. 253.)

Bensonia jacquemonti, ? Ed. v. Martens, var. kurramensis, G.-A. (Plate XCV. figs. 1–1 *i*.)

*Locality*. Kurram Valley, N.W. Frontier (*M. T. Ogle*).

Shell (fig. 1 *i*) depressedly turbinate, perforate, of solid construction: sculpture irregularly striate with the lines of growth; under high power the surface is smooth; colour milky white throughout, no band (in a few specimens a very faint band can be seen), polished particularly below; in a young specimen a decussate surface was visible; spire flatly conical, in a few (10 per cent.) it was much higher, subconic; apex depressedly conoid (height of spire is very variable); suture moderately impressed; whorls 7, very closely wound at the apex, regularly increasing, the last rounded on the periphery, beneath rather flat, the umbilical area shallow; aperture horizontally lunate, oblique; peristome sharp, in old specimens there is a very considerable thickening just inside the edge; columellar margin very oblique, slightly reflected.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | mm. | | mm. | | mm. |
| Size: | most conic.. | maj. diam. | 19·0, | min. | 17·75; | alt. axis | 9·5 |
| | largest .... | ,, | 29·0, | ,, | 18·0; | ,, | 8·5 |
| | average .... | ,, | 17·9, | ,, | 16·5; | ,, | 7·5 |

The credit of first finding and sending to England the species I now describe is due to the late Mr. M. T. Ogle, of the Indian Survey Department, who made a collection of shells when passing through the Kurram Valley into Kabul with the force under Lord Roberts. The shells were, however, mostly old, and a considerable number were filled with earth, having, as mentioned by Mr. Ogle, been taken out of banks. I made a description of the shell at the time, but never published it, as I could not place it in its generic position with any degree of certainty, because, coming from this western part of India, it might have been a true *Helix*.

I am now indebted to Captain A. H. Montagu, of the 21st Punjab Infantry, to whom I sent one of the shells, and who was lately quartered in the valley, for a fine series of this species, not only preserved in spirit, but some reached me alive. On putting them in a saucer with a little warm water near the fire they very soon revived and became very active and enjoyed their first meal of lettuce after their long journey through the post. Captain Montagu found them very abundant in the low hills round the rice-fields, but higher up at Malana, under the Sufaid Koh range, where he was stationed, they were not met with.

Only one failed to survive the journey (it was just alive), and the anatomical detail was taken from it. I find it falls into the subgenus *Bensonia*, type *monticola*, Hutton, = *labiata*, Pfr., of Simla and Mussoorie, a subgenus which ranges thence westward on the southern slopes of the Himalayas to Jamu in Kashmir territory, as recorded by Mr. Theobald, who described a variety, *jamuensis*, he got there.

Nevill described another variety, collected by Stoliczka near Murree, as var. *murriensis*. This carried the range of this subgenus of the Zonitidæ far along the hills north of the Punjab, and this new species now extends the range many miles further west beyond the Indus. Blanford has described a species from Murree as *Macrochlamys? wynnei*.

The animals of *B. jacquemonti*, var. *kurramensis* (Plate XCV. figs. 1, 1 *a*), vary a good deal in colour, from pale ash to pale ash tinged with green, and one is pale lemon-yellow; the head and tentacles are dusky ash, and this varies in intensity. The neck-lobes are conspicuously yellow. There is no central area on the sole of the foot; the pedal line is well marked, as well as the lateral grooves running from it upward and forward to the upperside of the foot, which is slightly keeled. Looking down vertically on the foot from above, these meet on the keel and form regular V-shaped segments (fig. 1 *b*), the angle of the V being directed towards the shell. The eye-tentacles are rather close together at the base.

It measures when extended 40 mm.

The mucous gland (figs. 1 *b*, 1 *c*) is large, with a blunt slightly overhanging lobe, and the extremity of the foot is rounded.

There is no right shell-lobe; the left is simple, and extends along the whole edge of the peristome, reflected over it.

The right neck-lobe is large and simple (fig. 1 *d*); the left is divided into two—one, large, next to the respiratory orifice, then there is a gap, followed by another distinct lobe, which has a tongue-like expansion on both sides, and on the anterior side it gradually narrows away to the umbilicus.

The shell is extremely transparent on the body-whorl, so that the branchial venation is beautifully seen through it.

The jaw is well arched and has a strong central projection. The central tooth as in typical species; the laterals, though bicuspid, have the outer cusp below the inner.

$$40 \;.\; 1 \;.\; 18 \;.\; 1 \;.\; 18 \;.\; 1 \;.\; 40$$
$$59 \;.\; 1 \;.\; 59$$

The outermost laterals are very minute in comparison with the central teeth; they are short and bluntly bicuspid (fig. 1 *h*), and the odontophore is exactly as in *Bensonia labiata*, Pfr. (Plate LXI. figs. 5 *a–a″*). The resemblance with this species extends to the generative organs: on getting these out, the most striking feature is the pink colour of the spermatheca (fig. 1 *f*).

The male organ (fig. 1 *e*) has a well-developed kalk-sac close to the connection of the vas deferens. The retractor muscle is given off from a closely-wound cæcum-like portion of the penis-sheath. The spermatheca is peculiarly long, with a very narrow duct below, but swelling out above into a large bulbous head. The amatorial organ (fig. 1 *g*) is large, cylindrical, and bent on itself. It is very muscular, and under transmitted light presents a pale-coloured central mass, pointed at the posterior end, and at the anterior ending in a close spiral with a very fine point. This spiral form is, I imagine, due to longitudinal shrinking, and in life is, in all probability, quite straight.

BENSONIA JACQUEMONTI, ? Ed. v. Martens.

*Bensonia jacquemonti*, Clessin, Nomen. Helic. p. 41; Tryon, Man. Conch. 2nd ser. vol. ii. p. 108.

*Locality*. Kurram Valley (*M. T. Ogle*).

Shell very depressedly turbinate, perforate, not fully grown; sculpture, striate lines of growth, under strong power the general surface is finely decussate, polished below; colour pale ruddy, with a grey tint, grey and white below, with a pale rufous band just above the periphery; spire very low, apex very flat; suture shallow; whorls 5, the last rounded; aperture horizontally lunate; peristome sharp, very slightly reflected at the columellar margin.

Size: maj. diam. 16·0, min. 13·8; alt. axis 6·5 mm.

This specimen arrived not long after it had died, and I could make out the mucous pore and pallial line; mantle-lobes had decayed away.

Jaw with a central projection. Radula similar to that of *Bensonia*, with bicuspid laterals; formula :—

25 . 11 . 1 . 11 . 25
36 . 1 . 36

The generative organs were broken and separated, but the amatorial organ was seen; it is cylindrical, rather short, with a blunt knob at the anterior end. A part of the male organ showed a spermatophore, elongate and with serrated edges; its form differs from var. *kurramensis*, described above, in being narrower and longer in proportion to its size.

Of this banded species I have two specimens lent me by Mr. Blanford, who received them from Major Wilmer, who, again, received them from the collector, Colonel Sillery, of the 13th Regiment; they are marked "Afghanistan?" I am informed since by Major Wilmer that they were probably from Cherat.

The largest is 21 mm. in major diameter of 6 whorls, and it agrees with my Kurram example.

I have also four fully-grown specimens and three young of this same banded shell, obtained by my son, Captain R. A. Godwin-Austen, of H.M. 54th Dorset Regiment, when quartered at Cherat, in the Kuttak Hills. These are the largest examples I have seen, and are very solidly built shells, one of which I now describe.

Bensonia wynnei, W. T. Blf. (Plate XCV. figs. 2, 2 *a*, 2 *b*.)

*Bensonia wynnei*, Tryon, Man. Conch. 2nd ser. vol. ii. p. 108.

*Locality*. Cherat, Kuttak Hills (*R. A. Godwin-Austen*).

Shell subturbinately depressed, narrowly perforate, of solid form; sculpture, close irregular striation of growth, no other striation, a young transparent shell of five whorls shows a fine network of diagonal lines crossing nearly at right angles; colour stony white, with a narrow rufous band above the periphery following the suture above on the inner whorls; spire with rounded sides; apex blunt; suture yellow; whorls 6, close and increasing very regularly, the last rounded and slightly descending at the aperture; aperture lunate, very oblique; peristome simple, rather solid; columellar margin solid, slightly reflected.

| | | | | |
|---|---|---|---|---|
| Size: largest .. | maj. diam. 21·5, | min. 19·5; | alt. axis | 10 mm. |
| smallest .. | ,, 19·0, | ,, 17·5; | ,, | 8·5 ,, |

I have compared this with a typical specimen of *B. wynnei* from Murree; they are evidently the same species.

Blanford (P. A. S. Bengal, vol. xlii. pt. 2, 1880, pp. 197–199, pl. iii. figs. 5, 5 *a*) described the typical Murree form as follows :—

"Macrochlamys? wynnei, W. T. Blf. [Plate XCV. figs. 3, 3 *a*, from a shell in his collection.]

"*Testa perforata, subturbinato-depressa, striatula, nitida, albido-cornea, diaphana, fasciâ rufâ supra peripheriam circumdata. Spira*

*depresso-conica, apice obtuso, suturâ leviter impressâ, fasciâ rufâ intus marginatâ. Anfr.* $5\frac{1}{2}$, *lente accrescentes, ultimus peripheria rotundatus, subtus modice convexus, aperturam versus vix descendens. Apertura late lunaris, obliqua, diagonalis; peristoma tenue, intus haud incrassatum, margine basali subrecto obtuso, columellari reflexo.*

"Diam. maj. 19, min. $17\frac{1}{2}$, axis $9\frac{1}{2}$ mm. (ex icone). In exemplo minore diam. maj. $13\frac{1}{2}$, min. $12\frac{3}{4}$, axis $7\frac{1}{2}$ mm. Apert. 7 lata, 6 oblique alta.

"*Hab.* ad Mari (Murree) in montibus Himalayanis occidentalibus inferioribus haud procul a fluviæ Jhelum (*A. B. Wynne*).

"Var. *major, depressa, anfractibus* 6, *spirâ convexâ, parum elevatâ.*

"Diam. maj. $21\frac{1}{2}$, min. 19, axis 10 mm. Apert. $11\frac{1}{2}$ lata, 10 oblique alta.

"*Hab.* etiam ad Mari.

"Shell perforate, subturbinately depressed, faintly striated, polished, white, translucent, surrounded by a narrow rufous band above the periphery. Spire depressedly conical, apex obtuse, suture slightly impressed, and with a rufous margin inside. Whorls $5\frac{1}{2}$, increasing slowly and regularly, the last rounded at the periphery, moderately convex beneath, scarcely descending towards the mouth. Aperture broadly lunate, oblique, diagonal; peristome thin, not thickened inside, basal margin almost straight, columellar reflected. (Dimensions as above.)

"There is a larger variety, more depressed, with a spire convex and six whorls. It may possibly be a distinguishable form, but I think not. (Dimensions as above.)

"I greatly question whether this form is really a *Macrochlamys*, and cannot help suggesting the possibility of its belonging to a different subgeneric group, or even to *Zonites*. However, it is associated at Mari with a true *Macrochlamys* (*M. prona*, Nevill, 'Scientific Results of the Second Yarkand Mission,' Mollusca, p. 17), and two or three species of *Helicarion*; so it is evident that a few of these tropical types extend to this extreme north-western portion of the Himalaya range, where, however, the majority of the Mollusca consist of *Bulimini* of the *Petræus* section.

"The specimen of *M. wynnei* from which the accompanying figure was taken has been mislaid or lost, and the description is drawn up from a small individual. I have named the shell after Mr. A. B. Wynne, of the Geological Survey of India, to whom I am indebted for several Mollusca from the neighbourhood of Mari. I have been in some doubt as to whether this might not be a form of the shell described by Prof. v. Martens as *Nanina jacquemonti* (Malak. Bl. xvi. 1869, p. 75; Pfr. Nov. Conch. iv. p. 48, pl. cxviii. figs. 6–8); but, in the first place, it can scarcely, I think, be the species figured by Jacquemont (Voyage dans l'Inde, Atlas, pl. xvi. fig. 2), and, secondly, *N. jacquemonti* is described as having '*peristoma obtusum, intus incrassatum, margine . . . . basali leviter arcuato,*' none of which can apply to the present species. Pfeiffer's

figure in the 'Novitates' shows a very much less oblique mouth than is found in *Macrochlamys? wynnei*. Now, I have another species from Mari, which agrees admirably with Martens's description in these respects and which resembles Jacquemont's figure also, but it wants the red band round the periphery shown in Pfeiffer's figure. It is just possible that two species are included by Martens. The true *N. jacquemonti* is probably a *Bensonia*."

Jacquemont does not seem to have got further west in the Punjab than Jhelum, and from that town he passed through Mirpur, Kotli, and Poonch, which he spells Prountche (and not incorrectly, for it is thus pronounced by the Kashmiri lower orders), to the Pir Panjal.

### Subgenus Haughtonia, nov.

Animal with a short foot behind, not divided below; mucous gland large and open, no overhanging lobe. A mere indication of a right shell-lobe, but none of a left. Anterior left dorsal lobe distinctly separate from the posterior one. Male organ simple, bent on itself, kalk-sac extremely small and globose. Amatorial organ very long, much convoluted. Spermatheca long pear-shaped. Jaw with a concave plain edge. Central teeth numerous, with very reduced cusps on the outer side; laterals bicuspid.

Sculpture of shell sharply chiselled longitudinal striæ.

### Haughtonia conferta, Pfr. (Plate XCIX. figs. 1–8.)

*Helix conferta*, Pfr. P. Z. S. 1856, p. 328 (Mus. Cuming), type in Brit. Mus.

*Helix chambertinii*, Tryon, Proc. A. S. B. 1870, p. 87.

*Helix haughtoni*, Bs. A. M. N. H. 1863, xi. p. 87; Pfr. Mon. Hel. vol. iv. p. 183; Hanley, Conch. Ind. p. 14, pl. xxviii. fig. 3.

*Rhysota haughtoni*, Bs. Theob. Supp. Cat. p. 23.

*Nanina* (*Rhysota*) *haughtoni*, Bs., Nevill, Hand-list, p. 46.

*Helix chambertinii*, Tryon, Amer. Journ. Conch. pt. 2, vol. v. p. 109, pl. x. fig. 2 (1869).

*Rhysota conferta*, Pfr., Godwin-Austen, J. A. S. B. vol. li. pt. 2. p. 70, animal, pl. v. fig. 6 (1882).

*Hemiplecta haughtoni*, Clessin, Nomen. Helic. p. 50.

*Nanina* (*Hemiplecta*) *haughtoni*, Tryon, Man. Conch. 2nd ser. vol. ii. p. 39.

The generic position of this the largest of the Andaman land-shells has long remained a point to be cleared up, and I am glad to be at last enabled to give a description of its anatomy, and show to what extent it differs from the larger forms of Ceylon and Peninsular India on one side, and those of Tenasserim and the Malay Peninsula on the other.

In 1882 I published a figure of the animal taken from a drawing made under Ferd. Stoliczka's superintendence. I then wrote: "Nevill's Hand-list, p. 46 (1878), places it in the subgenus *Rhysota*,

which I follow until an anatomical comparison shall be made with *R. ovum* the type of the genus by Albers."

It will be seen on comparing Prof. Semper's figure of the generative organs of *R. ovum* (Reis. in Arch. Philipp. p. 69, pl. iv. fig. 1, 1870) that they have no similarity to those of the Andaman shell. The genitalia of *R. ovum* are of the most simple form, especially as regards the male organ.

Description in Mon. Helic. Vivent. :—" *Testa umbilicata, conoidea, solida, striis incrementi irregularibus et confertissimis spiralibus decussatula, sericea, fulvida, spira conoidea, obtusa ; sutura pallide marginata ; anfr. vix 5, convexiusculi, sensim accrescentes, ultimus peripheria angulatus, ad suturam turgidulus, basi convexus, juxta umbilicum angustum compressus ; apertura perobliqua, subtetragono-lunaris ; perist. obtusum, margine supero recto, basali incrassato, reflexiusculo, columellari declivi, subdentato, superne triangulatim reflexo.*

" Diam. maj. $34\frac{1}{2}$, min. 30, alt. 20 mill. (Mus. Cuming).

" Habitat ? "

Stoliczka made the following note in pencil on the drawing * :—

" —— ? *haughtoni*. Andamans.

" Animal dark brown, reddish at the pedicles. Mantle thick, greyish brown, freckled with white : body very rough, looks like *shielded* (? *chiselled*); pedal row very distinct and the elongated tubercles whitish, basal edge pale greyish brown. Tail-gland distinct, surrounded by a swollen edge."

Original description (*Helix haughtoni*, Benson) :—" *Testa perforata, subumbilicata, solidula, subtrochiformi, irregulariter oblique obsolete plicatula, confertissime et minutissime spiraliter striata, epidermide rubenti-olivacea ; spira depresse conoidea, apice valde obtuso, sutura impressa ; anfr.* $4\frac{1}{2}$–5, *convexis, ultimo antice breviter vix descendente, ad peripheriam angulato, subtus convexo, circa umbilicum intus callo arctatum compressiusculo ; apertura obliqua, subrotundato-lunata, subquadrangulari, intus albida, peristomate recto, marginibus callo tenuissimo junctis, dextro intus subincrassato, columellari superne breviter reflexiusculo, subtus incrassato, intus dente calloso interdum munito.*

" Diam. maj. 31, min. 27, axis 19 mill.

" Habitat in insulis Andamanicis.

" Detexit Major J. C. Haughton.

" This is the largest *Helix*, and the most peculiar in form and in the formation of the aperture, yet received from these islands, the columellar callus in one specimen recalling the appearance observable in some Mauritian *Helices*. In a second specimen, this protuberance is more slightly developed. I am indebted for it to Major Haughton, late Superintendent of the Andaman Colony, now Chief [?] [Deputy in 1863] Commissioner in Assam, whose search

* Fig. 38 (uncoloured) of MSS. Drawings in Library, Indian Museum, Calcutta.

for the land-shells of the locality has added largely to our knowledge of the island forms."

I am much indebted to Dr. Adolf B. Meyer, Director of the Royal Zoological Museum, Dresden, for the specimens now described, as well as for several other interesting forms I hope to publish hereafter.

Animal with a short foot (Plate XCIX. fig. 1), noticeable in Stoliczka's drawing; the pallial margin broad, well segmented; the pallial grooves two, defining a distinct line of tubercles. The foot below is not distinctly divided. The mucous gland is wide and rather open, with no lengthened overhanging lobe (fig. 2), the opening does not extend to the sole of the foot.

There are no shell-lobes, the mantle-edge is turned back over the periphery of the shell, with an even width throughout. At the inner upper angle of the aperture (fig. 4) there is an indication of a very minute shell-lobe, only to be seen with the lens *. The right dorsal lobe (fig. 3) is as usual; the left is divided into anterior and posterior parts, the first large and ample, the second long and narrow.

The sculpture of the shell magnified is peculiar: the irregular, undulating, transverse lines of growth are crossed by regular parallel grooves, with sharply-defined sides, as if engraved with a V-shaped tool.

In the odontophore the teeth are arranged thus:—

21 . 2 . 20 . 1 . 20 . 2 . 21
43 . 1 . 43

The median teeth (fig. 6) are large and broad, the central tooth having only an indication of the usual side cusps, in this case shown by a slight short shoulder about halfway down. In the median teeth (fig. 6 *a*) also the outer cusp is very slightly developed, and is better described as a broad sloping shoulder; the inner margin of these median teeth is straight. At the 22nd tooth the cusp is much nearer to the apex, and at the 23rd the lateral teeth commence and are bicuspid, with the inner point the longest; the outermost or marginal teeth (fig. 6 *b*) are small, blunted, and bicuspid.

The jaw (fig. 7) is deeply concave on the cutting-edge, with no indication whatever of a central projection.

*Generative organs* (figs. 5–5 *b*). In these, in proportion to the size of the shell, the great length of the amatorial organ is remarkable (fig. 5), being 55 mm. long, as compared with that of *Hemiplecta humphreysiana*, Lea, which is 40 mm., and *Hemiplecta? floweri*, E. Smith (Proc. Malacol. Soc. of London, vol. iii. no. 5, p. 284), of Perak, which is 75 mm.

The spermatheca is small and rather short, pear-shaped on a stalk. The male organ (figs. 5 *a*, 5 *b*) consists of a short sheath encircled by a muscular band, and with this band is tied in a small globose sac, representing the kalk-sac or flagellum; indication was

* Compare this with fig. 1 *a*, Plate XCVIII.

observed in the specimen dissected of a spermatophore. The vas deferens joins here. Thence a long duct leads posteriorly to the retractor muscle; it bends sharply forward in a short narrow tube which leads into a much wider bulbous portion, this uniting with the lower main short sheath first mentioned, leading to the genital aperture. The swollen bulbous portion on being laid open is seen to have papillate walls.

This genus presents very few characters in common with *Nilgiria* and *Ratnadvipia*, shown outwardly in the divided left dorsal lobes, the general form of the foot and mucous gland, and internally in the genitalia; we do not find the cæcum-like process below the retractor muscle peculiar to those South-Indian genera. The radula differs also from them. It approaches nearer to *Hemiplecta*, as shown in the generative organs, but in form of the central teeth and the shell-lobes considerable variation is to be seen. On the whole it stands apart, and the differences are sufficient to give it the subgeneric position I have assigned to it under the title *Haughtonia*, named after that gallant, talented, and distinguished officer, its discoverer, who at one time was serving in the Andamans, and collected there for Mr. Benson.

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## Subgenus Nilgiria.

(*Continued from* Part VIII. Vol. II. pp. 77–81, Plates LXXX.–LXXXII.)

Nilgiria ligulata, Férussac. (Plate XCVIII. figs. 1–1 *d*.)

*Helix* (*Heliogena*) *ligulata*, Fér. Hist. Moll. pl. 31. fig. 2; Pfr. Symb. i. p. 38.

*Helix ligulata*, Chemn. ed. ii. Helix, no. 174, t. 33. figs. 1, 2; Pfr. Mon. Hel. vol. i. p. 71; Reeve, Conch. Icon. lxxvi. fig. 395; Hanley, Conch. Ind. p. 14, pl. xxvii. fig. 2 (good figure).

*Nanina ligulata*, Beck, Ind. p. 4.

*Hemiplecta* (sec. A) *ligulata*, Theob. Supp. Cat. p. 21.

*Nanina* (*Xesta*?) *ligulata*, Nevill, Hand-list, p. 50: Madras, Chaibassa in Chota Nagpur to Bhagulpur and Patna.

*Hemiplecta*? *ligulata*, G.-A. J. A. S. B. vol. xlix. pt. 2, 1880, pl. ix. fig. 3; copied from a drawing of the animal by a native artist, under the superintendence of Ferd. Stoliczka.

*Xesta ligulata*, Albers, Die Heliceen, p. 50 (1860); Reis. Archipel Philipp. p. 65, pls. iii., v., vi. (1870); Clessin, Nomen. Helic. p. 41.

*Nanina* (*Xesta*) *ligulata*, Tryon, Man. Conch. ser. 2, vol. ii. p. 78.

In this species received from Madras, on the body-whorl, side, and inside the mantle-zone a very fine line may be seen following the edge, and thus defining a narrow hem-like band (*vide* Plate XCVIII. fig. 1 *a*), but there is no shell-lobe on the right side, only a narrow left shell-lobe. The left dorsal lobe (fig. 1 *b*) is in one long continuous piece, but there is only a small notch indicating

the usual division of this lobe. As in *N. tranquebarica* and *N. bistrialis*, the muscular diverticulum (*crp*, fig. 1 *c*) is very long, near to its base (a portion of the penis which Semper calls the "*cæcum musculi retractoris penis*") strong muscles attach it closely to the penis-sheath, and a long free portion is coiled tightly together and returns to the same point. A short free portion extends to the junction of the vas deferens, and the part analogous to the flagellum is very short. The spermatheca is oval, small, and sessile; the amatorial organ of moderate size. The salivary gland is spread out widely and thinly over the surface of the alimentary canal, which is expanded behind the œsophagus into a long ample sac.

Among the many interesting molluscs sent me by Mr. O. Collett was *H. chenui* of Benson, which, as will be shown from the drawings and description I have made of its anatomy, falls into this genus. Furthermore it can be placed in the grouping of *Ariophanta* and *Nilgiria* (*vide* p. 82), with the South-Indian *N. bistrialis*, the laterals being aculeate and the median teeth bicuspid.

Nilgiria chenui, Pfr. (Plate XCVI. figs. 1–9.)

*Helix chenui*, Pfr. in Zeitschr. f. Malak. p. 145 (1847); Chemn. ed. ii. Helix, no. 739, t. 119. figs. 14–16; Pfr. Mon. Hel. vol. i. p. 438; Reeve, Conch. Icon. lxxii. fig. 370; Hanley, Conch. Ind. p. 13, pl. xxv. fig. 1.

*Helix chenui*, var., Hanley, Conch. Ind. p. 13, pl. xxvii. fig. 4.

*Hemiplecta* (sec. D) *chenui*, Theob. Supp. Cat. p. 22.

*Nanina* (*Hemiplecta*) *chenui*, Nevill, Hand-list, p. 47.

*Hemiplecta chenui*, Clessin, Nomen. Helic. p. 50; Tryon, Man. Conch. p. 38.

Description in Mon. Hel.:—"*T. subperforata, depressa, tenuiuscula, striis subtilibus et lineis impressis spiralibus malleato-subdecussata* *, *castaneo-fulva; spira obtusa; anfr.* 4½, *planiusculi, ad suturam rugoso-striati, ultimus angulatus, non descendens, fascia peripherica pallida et adjacente castanea, deorsum diluta ornatus; apertura parum obliqua, truncato-ovalis, intus opalina; perist. rectum, subsimplex, margine columellari subincrassato, ad perforationem clausam breviter dilatato-reflexo.*

"Diam. 40, alt. 20 mill.

"Habitat dicitur in insula Ceylon.

"Nahe verwandt mit *Hel. bulla* und *sagittifera*."

The first of these is the type of Professor Semper's Group B of the genus *Rhysota*, with very different genitalia and odontophore.

Mr. O. Collett writes in Journ. Roy. Asiat. Soc. Ceylon Branch, no. 48, vol. xv. 1897, p. 2:—"This species is fairly common throughout the district (Ambagamuwa, Ceylon). It closely resembles the South-Indian form *H. chenui*, with which it is in all probability

* The sutural edge is crinkled by the transverse folds of growth, and these are crossed by rather obscure longitudinal lines where they are finer and stronger (Plate XCVIII. fig. 3).

identical. The animal is dirty white, marked with longitudinal grey bands; it is very slimy, and makes a peculiar squeaking noise, like a beetle, when molested. It is oviparous from May to August. The eggs are 8 mm. long and 4 mm. in width; they are oval, pointed at the ends, and carinated longitudinally; they are pure white in colour and quite soft (uncalcified).

"Habitat among decaying vegetation.

"Young animals are of a brick-red colour, visible through their transparent shells."

The shell is well figured on pl. xxv. fig. 1 of the 'Conchologia Indica'; it is therefore unnecessary for me to give another.

From the above district in Ceylon Mr. Collett sent me the specimen here described.

*Animal* (Plate XCVI. figs. 1 & 2). Grey with a pinkish tinge, darkest on the extremity of the foot in one specimen. Very little can be said of value as regards the coloration of specimens preserved in formalin; and although it does not contract the animals nearly so much as alcohol, it leaves them in a very brittle condition, and far greater care must be taken in handling them. The right shell-lobe (fig. 2) is represented by a very small flap, situated near the respiratory aperture; this flap is an expansion on the dividing line of the dorsal lobe and narrows backward towards the posterior margin of the mantle-zone, which, on the body-whorl side, and viewed from the inside (that is, the surface next the shell), is seen to form a distinct band with an equal breadth of $2\frac{1}{2}$ mm. contracted. Compare this also with the right shell-lobe of *Ratnadvipia* (Plate LXXXV.) and *Nilgiria ligulata* (Plate XCVIII. fig. 1 *a*). The left shell-lobe is also a narrow fillet overlapping the peristome, 2 mm. broad, but it has no tongue-like process on the left margin. The right dorsal lobe is triangular and ample. The left dorsal lobe is in two distinct parts, the anterior being the largest and it distinctly overlaps the smaller narrower posterior lobe; in this respect it differs from typical *N. solata* and other species of the genus, where no division of this lobe is found, and yet it is not division of the same kind as is seen in *Ariophanta*, &c., showing differentiation as far as this character is concerned. These lobes are all darker than the foot of the animal. The sole of the foot is similar to that of *R. irradians*, it has not the very distinct division as seen in *Macrochlamys*, &c.; the segmental lines on the pallial margin extend for some distance towards the central area, but the dividing line of the two is very obscure. There is a distinct tendency to contract on the central line, and the surface under the lens is distinctly and closely striate longitudinally (*vide* Plate LXXXV. fig. 3). The pallial line above the broad margin is ill-defined; irregular small tubercles take the place of those of the usual oblong form. The mucous gland (figs. 3 & 4) is large and extends to the sole of the foot. It is rounded above, with no overhanging lobe.

The retractor muscles of the eye-tentacle and the amatorial organ have their attachment very close together. The salivary gland is

very large, in one mass, bilobed, and spreading over the expanded stomach.

The generative organs are very similar to those of *Nilgiria solata*; the diverticulum of the penis (figs. 6, 7), to which the retractor muscle is attached, is short, and a distinct muscle is attached to the flagellum near the junction of the vas deferens.

The dental formula is :—

$$\frac{58 \;.\; 1 \;.\; 25 \;.\; 1 \;.\; 25 \;.\; 1 \;.\; 58}{84 \;.\; 1 \;.\; 84}$$

The central tooth and the median teeth have large cusps on both sides; in this radula (fig. 8) the 2nd median on the right side is abnormally broad, and this variation runs through (as is always the case) every row of the radula. At the 20th tooth (fig. 8 *a*) the cusps become very small, at the 23rd the inner disappears, at the 25th there is only a trace of the outer; the laterals (fig. 8 *b*) are aculeate, the marginal (fig. 8 *c*) are short and bicuspid, to straight-sided and blunt. The jaw (fig. 9) has a flat convexity on the cutting-edge.

Nilgiria ceylanica, Pfr.

*Nilgiria ceylanica*, Pfr. Zeits. Malak. 1850, p. 67; Chemn. ed. ii. Helix, no. 795, t. 127. figs. 6, 7.

*Helix bistrialis*, var. *β*, Pfr. Mon. Hel. vol. i. p. 71.—"*Testa solidiore, superne distinctius decussata.*"

*Helix ceylanica*, Pfr. Mon. Hel. vol. iii. p. 71; Reeve, Conch. Icon. ccii. figs. 1420 *a*, *b*; Hanley, Conch. Ind. p. 14, pl. xxix. fig. 3 (good figure).

*Hemiplecta* (sec. B) *ceylanica*, Theob. Supp. Cat. p. 22 = *bistrialis*, Beck, and *taprobanensis*, Dohrn.

*Nanina* (*Xesta*?) *ceylanica*, Nevill, Hand-list, p. 51.

*Hemiplecta ceylanica*, Albers, Die Heliceen, p. 53 (1860), separates it from *bistrialis*; Collett, Journ. R. Asiat. Soc. Ceylon Branch, vol. xv. (1897); Clessin, Nomen. Helic. p. 49.

*Nanina* (sec. *Xestina*) *ceylanica*, Tryon, Man. Conch. p. 84.

Collett in list of the Terrestrial Mollusca of Ambagamuwa says: "This species is abundant in Lower Ambagamuwa, but it is not found in the upper part of the district.

"Habitat among the fallen leaves in damp shady localities, 2000 ft."

Original description:—"*T. perforata, subgloboso-depressa, solidula, superne distincte granulato-decussata, diaphana, parum nitida, pallide rubello-cornea; spira breviter convexo-conoidea; anfr.* $4\frac{1}{2}$ *parum convexi, sensim accrescentes, ultimus medio fascia albida, utrinque linea rufa marginata* (*supera interdum deficiente*) *cinctus; apertura mediocris, obliqua, rotundato-lunaris; perist. simplex, rectum, obtusum, margine columellari subincrassato, superne leviter reflexo.*

"Diam. maj. 26, min. 21, alt. 13. mill.

"Var. *β. Major, unicolor fulvo-lutea.*

"Diam. maj. $32\frac{1}{2}$, min. 28, alt. 17 mill.

"Var. *γ. Fascia mediana alba deficiente, unica castanea magis*

*vel minus lata ejus loco posita, interdumque nonnullis lineis rufis ornata.*

"Habitat in insula Ceylon.

"*Obs.* Distinguenda ab *H. bistriali* testæ structura et sculptura, anfractum et aperturæ ratione, etc."

Two specimens beautifully preserved in formalin were sent me by Mr. Collett, measuring

(1) Diam. maj. 30·05, min. 26·5 mm.
(2) „ 24·0 · „ 19·5 „

both with a narrow dark band on the periphery; they both show the form of the mantle-lobes almost as well as when the animals were alive, and I selected the smaller of the two for dissection. The right shell-lobe is narrow above, as in *N. chenui*, decreasing gradually in width down the side of the body-whorl to the posterior margin of the shell; the left shell-lobe is turned over the peristome for its entire length. In this specimen, although the left dorsal lobe is not divided, as it is in *N. chenui*, there is just the very faintest indication of such division shown in a very slight cicatricial line, and a slight indentation on the thin edge of the lobe. The other specimen does not show this at all. The foot is not divided, and under the lens it is longitudinally striated.

The genitalia are of the same type as *N. chenui.*

The odontophore is also similar in the form of the teeth (*vide* Plate XCVI. figs. 8–8 *c*); the formula differs, being

$$\frac{62 \;.\; 2 \;.\; 19 \;.\; 1 \;.\; 19 \;.\; 2 \;.\; 62}{83 \;.\; 1 \;.\; 83}$$

The jaw is like the one figured on the same Plate, fig. 9; the difference lies in the central teeth of *N. chenui* being more numerous, 53 against 43 in *N. ceylanica*; the two species are thus very closely allied. It may here be pointed out that *N. bistrialis* of Madras, of which the shell is certainly very much like that of *ceylanica*, so much so that some conchologists have considered them inseparable, differs only slightly in the number of teeth, centrals=39. The generative organs are on the same plan. I have never noticed in the Madras specimens any sign of division of the left dorsal lobe. The slight difference observable in the shells between those of the Indian Peninsula and Ceylon is thus carried out in the animals.

These South-Indian species are much wanted for examination, as they may belong to *Nilgiria*: *belangeri, bombayana, semirugata, vitellina, sisparica, basilessa, basileus, madraspatana*, &c. Ceylon: *juliana, ganoma**, *rosamunda, taprobanensis.*

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### Ariophanta.

(*Continued from* Vol. II. p. 82.)

As further material comes to hand, a better knowledge is afforded us of generic characters. Mr. W. T. Blanford has lately described (Proc. Malacol. Soc. London, vol. iii. pt. 5, p. 282, shell figured) a

* While going to press I have received three specimens of this species. It is remarkably close to *N. chenui.* They were also collected by Mr. Collett, and were kindly sent on to me by Mr. Blanford.

subspecies of *Ariophanta cysis* under the title of *A. dalyi*, sent by Mr. W. M. Daly from the Kadur district, Mysore. He kindly handed me the animal for examination, and I am now enabled to give a figure of the genitalia, the very brief account of which appears in the above paper. I copy his description of the shell:—

"ARIOPHANTA DALYI, W. T. B., subspecies. (*A. cysis*, var.) (Plate XCVIII. fig. 4.)

"*Testa sinistrorsa, umbilicata, depresso-globosa, tenuis, oblique striata, fusco-cornea, fascia pallide ad peripheriam circumdata, subtus juxta umbilicum pallido-cornea ; spira convexo-conoidea, apice obtuso, sutura impressa ; anfr.* 5 *convexiusculi, ultimus non descendens, ad peripheriam obtuse angulatus, antice latior, superne planulatus, subtus tumidus, nitidus ; apertura ampla, diagonalis, oblongo-ovata, vix lunata, margine superiori recto ; perist. album, interdum roseo-tinctum, margine superiori vix, dextrali basalique expansiusculis, columellari reflexo.*

"Diam. maj. 39, min. 31 ; alt. 22 mm.

"*Hab.* Balur, province of Kadur, Mysore.

"This form differs from typical *A. cysis* by having a higher spire, by the last whorl being subangulate at the periphery, by its darker colour, and by the whitish band round the last whorl. The mouth, too, is differently shaped, owing to the upper margin in *A. dalyi* being straight, not curved. The spiral striation of *A. thryseus* is completely wanting, as it is also in typical *A. cysis*. The form of *A. cysis* figured in the 'Conchologia Indica,' pl. xxv. fig. 5, and said by Hanley (*t. c.*, Systematic List of Species, p. vii, footnote) to be the variety named *Helix ampullaroides* by Reeve, approaches more nearly to *A. dalyi* than any other described race, but differs considerably. From *A. intumescens* the present form may be at once distinguished by its more depressed form, much wider umbilicus, and differently shaped mouth."

*Animal.* The left neck-lobes are separated into two parts.

*The genitalia* (fig. 4). The male organ is much simpler than in *A. lævipes*, although of the same type. The retractor muscle is given off from a stout long cæcum (*crp*) continuous with the main sheath below. At the junction of these two parts is the kalk-sac, on a very short tube which the vas deferens joins. It is thus strikingly similar to the same part in *Ratnadvipia* (Plate LXXXV. fig. 6).

The spermatheca is very short and oval in shape ; the amatorial organ short and stout. At the head of the vagina, above the junction of the spermatheca, is an enlargement of the main duct (fig. 4, *ot*), a glandular cæcum, which is also present in *A. lævipes*.

The odontophore is nearest to *A. cysis* and *A. immerita* (*vide* Plate LXXXII. figs. 6–6 *c*, 7–7 *c*), arranged thus :—

$$+30 \;.\; 3 \;.\; 17 \;.\; 1 \;.\; 17 \;.\; 3 \;.\; 30+$$
$$+50 \;.\; 1 \;.\; 50+$$

The salivary gland is very broad and spread out in a thin film over the surface of the stomach.

Subgenus Khasiella, nov.
(Plate C. figs. 1–5 *d*.)

In my paper on the genus *Euplecta* (Proc. Malac. Soc. vol. ii. pt. 4, April 1897) several North-east Frontier shells were included in it, as originally placed by Mr. W. T. Blanford, on shell-character principally, so little being known of the animal. During the past year or so I have had the opportunity of dissecting a good many species from Ceylon and Southern India, and among them specimens of *Euplecta* in good preservation. With this knowledge, I became more than ever impressed with the improbability that this Ceylon genus would be found extending to the Khasi Hill range and the hill-country to the eastward. This impression I alluded to in my Presidential Address to the Malacological Society (p. 251).

Most fortunately, when cataloguing the large number of species preserved in spirit in my collection, now in the Natural History Museum, I came on an unsorted bottle of shells collected by Mr. M. T. Ogle on the first high ridge thrown off from the Burrail Range, on the road between Cachar and Munipur. In this I discovered four specimens of *Euplecta vidua*, W. T. Blf.

The anatomy, taken as a whole, is very unlike that of *Euplecta*, and being sufficiently distinct from other genera I am acquainted with, I feel it necessary to place it in a new subgenus of the Macrochlamidæ, for which I propose the name *Khasiella*.

The animal (Plate C. fig. 1) is dark grey about the head and neck, paling towards the extremity of the foot; the grey tint does not extend to the wide pallial fringe, which is almost colourless in spirit-specimens. The sole of the foot is strongly divided. The mucous gland (fig. 1 *a*) is wide, does not extend to the sole of the foot, and is overhung with a lobe.

The right shell-lobe (fig. 1 *b*) is quite small, the left (fig. 1 *c*) is long and narrow throughout. The left dorsal is in two parts, very distinctly separated the one from the other.

*The generative organs* (figs. 3, 3 *a*). Commencing at the retractor muscle, this latter is peculiarly short and solid, attached to a short free cæcum bent downward; at this part a long duct on one side terminates at the junction of the vas deferens and a long, blunt, knobbed kalk-sac; on the other side a long, thicker duct extends to the generative aperture; an enlargement is to be noted about half-way down, formed apparently by a sort of kink or fold in the duct. The spermatheca is long, with a bulbous end. The amatorial organ is moderately developed and of an olive-green colour.

*Odontophore* (figs. 5–5 *d*). The centre tooth (fig. 5) has well-developed cusps on each side; the median have only one on the outside, quite straight on the inner side; the 15th and 16th teeth are transitional in form; the 17th is bicuspid, the outer point much below the inner one: this outer point gradually rises nearer to the inner. About the 26th the laterals are long and narrow, still bicuspid, and about eighteen or twenty on the margin are long and aculeate. The jaw (fig. 4) has a central projection.

In general type of anatomy this species falls into the subfamily

*Macrochlaminæ*, as distinguished from those South-Indian molluscs which may be separated as the *Ariophantinæ*.

In the generative organs, making due allowance for the close-wound shell, which necessarily elongates the different parts, there are several characters indicating the above relationship:—(1) the long spermatheca; (2) the long kalk-sac or flagellum; (3) the part near the retractor-muscle attachment of the male organ—only differing, I may here observe, from typical *Macrochlamys* &c. by a short hook-like cæcum taking the place of one more or less coiled (Plate XXVIII. figs. 1 *a*, 1 *b*); (4) a right shell-lobe, although very reduced in size, is present; (5) the radula is of the same type, a few teeth on the margin aculeate.

Its subgeneric rank is supported by the form of the shell and its sculpture. If this conchological character only be considered, many a genus of the Mollusca has been founded on differences less appreciable than are to be found in *Khasiella vidua* and *Macrochlamys hardwickei*.

Khasiella vidua, W. T. Blf. (Plate C. figs. 1–5 *d*.)

*Euplecta vidua*, W. T. Blf. Journ. A. S. B. vol. xlix. pt. 2, 1880, p. 190, pl. ii. figs. 2 & 5.

*Helix vidua*, Blf. MSS.; Hanley, Conch. Ind. p. 52, pl. cxxx. figs. 2, 3.

*Nanina climacterica*, Bs. (var. *vidua* of Conch. Ind.), Nevill, Hand-list, p. 30: Naga Hills, Khasi Hills, Tezpur, and Sibsagar, Assam.

*Nanina* (*Macrochlamys*) *vidua*, Tryon, Man. Conch. p. 95.

Original description:—"*Testa imperforata, conoideo-depressa, superne oblique confertim atque arcuatim filiformi-costulata, subtus lævigata, polita, radiatim striatula, superne pallide cornea, subtus pallidior. Spira depresso-conica, lateribus subrectus; apice acutiusculo, sutura impressa. Anfr.* 8, *convexi, arcti, lente accrescentes; ultimus superne ad peripheriam angulatus, antice vix descendens, subtus convexus. Apertura obliqua, lunaris, latior quam alta. Peristoma obtusum, leviter sinuatum, intus vix albo-labiatum, margine basali arcuato, columellari vix reflexo.*

"Diam. maj. 17, min. 15½, axis 9½ mm.

"*Hab.* in montibus Garo, Khasi et Naga dictis, vallem Assamensam meridiem versus contingentibus (*Masters, Godwin-Austen*).

"*Varietas minor, depresso-turbinata, spira conica.*

"Diam. maj. 14, min. 12½, axis 9 mm. (Plate ii. fig. 2.)

"*Hab.* cum præcedente.

"Shell imperforate, conoidly depressed, above ornamented with oblique, close, and arcuate fine hair-like costulation, smooth and marked with radiating striæ below; pale horny, paler beneath. Spire depressedly conical, the sides nearly straight, apex rather sharp, suture impressed. Whorls 8, convex, narrow, slowly increasing in size, the last angulate above at the periphery, scarcely descending towards the mouth, convex below. Aperture oblique,

lunate, broader than high. Peristome not sharp, slightly wavy, with a very slight white thickening inside, the basal margin curved forward, the columella scarcely reflected.

"Major diameter 0·67, minor 0·62, axis 0·38 inch.

"The above is the typical form; but there is a smaller variety, depressedly turbinate in shape, with the spire conical, measuring 0·55 inch in its major diameter and 0·36 in height. This form passes by insensible gradations into the type.

"The shell represented in the 'Conchologia Indica' is intermediate between the two varieties here described and figured; the apex in the 'Conchologia' figure is more prominent and blunt than in the specimens now before me. These were procured from the Naga Hills, south of Gola Ghat, Assam, by Mr. Masters in 1859; other specimens were subsequently found on the Garo, Khasi, and Naga Hills by Colonel Godwin-Austen. The shells from the Khasi Hills have the filiform costulation on the upper surface finer and less regular than those from the Assam side of the Naga Hills. In Khasi shells 2, 3, or 4 ribs occur at nearly regular intervals, and then a rib appears to be omitted; this is not the case with those from Upper Assam.

"The species scarcely differs from *E. ornatissima*, found on the other side of the Brahmaputra Valley, at the base of the Sikkim Hills, except in being imperforate; *E. climacterica*, of which Mr. Nevill considers the present shell a variety, is always sharply keeled at the periphery. The two forms may pass into each other, but I have never seen any intermediate links; and as they differ from each other much more than *E. vidua* does from *E. ornatissima*, or *E. climacterica* from *E. austeni*, it is better to have distinctive names for them.

"I am indebted to Colonel Godwin-Austen for the following note on the animal of *A. vidua* observed at Cherra Poongee, Khasi Hills:—

"'Animal of a neutral grey tint about the neck and eye-tentacles, which are rather long and fine; the oral tentacles are also of a dark tinge. Extremity of foot truncated, with mucous gland. Body long and thin. No tongue-like processes on the mantle observed.'"

The following is my description, in the same paper, of the teeth in *E. climacterica*:—

"Median tooth tricuspid, the central point very long, the lateral cusps very small. The first 14 laterals are long and broad, with a single short small cusp on the lower outer margin; the 25 outermost are long and narrow, curvilinear, bicuspid, the outer point the shorter, being less than half as long as the inner. Jaw slightly curved, the front edge a little convex.

"The number of teeth in a row is apparently 79. A sketch shows that the form of both central teeth and laterals is very similar to that of *E. subopaca*." We now know that this is the form of the central teeth common to all the genera of the Zonitidæ, with modification in some of them.

*Khasiella* will include the following species:—

*K. vidua*, W. T. Blf. Assam Hills.
*K. climacterica*, Benson. Teria Ghat, typical locality.
*K. citrius*, G.-A. Naga Hills.
*K. austeni*, W. T. Blf. Garo Hills.
*K. serrula*, Benson. Khasi Hills.
*K.? ornatissima*, Benson. Darjiling.
= *submissa*, Benson.
*K.? falcata*, W. T. Blf. Garo Hills.
*K.? arata*, W. T. Blf. Burmah.
*K.? pansa*, Bs. Burmah.

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*Notes on the Spermatophore.*

A sufficient number of spermatophores have now been found and drawn, from which some estimate of their morphological value may be formed, and I drew attention to this in my Address to the Malacological Society, 1899:—"These structures will accentuate the value of certain main groups when the time comes to decide upon them." A detailed description of the forms they present may be interesting. The spermatophore adds another character which should be sought, if possible; for although, in closely-allied species, the general form will no doubt be found constant, yet the proportion of the different parts to one another, making up the whole structure, are likely to differ. It is in a generic sense that these interesting and beautifully-formed secretory bodies will be morphologically interesting, and prove, I think, of greater assistance than might be supposed in unravelling the successive development of the different groups of Indian Land Mollusca, particularly the Zonitidæ.

A distinction must be made between the form the spermatophore presents when found complete in the spermatheca, and those more closely packed in the flagellum of the male organ or on their passage down the same. The first-mentioned position is perhaps the most common one in which they may be observed, and I find they fall into well-marked groups.

It becomes necessary to give a description of the general form of a zonitoid spermatophore and create terms for the different sections, which I do not think has yet been done. I have referred to them previously in this work in Vol. I. at pp. 108, 109, & 230; Vol. II. pp. 79 & 80; and in the P. Z. S. 1880.

The posterior part consists of a more or less lengthened sac (the *capsule*) having a hard conical or oval extremity (*posterior*), an expansion of the thin tube which, further back, fills the inside of the vas deferens. The periphery of the cap or end merges into the thin transparent membrane forming the sac; this, again, below narrows suddenly, and the sides of the capsule are attached to a hard gutter-like portion, which may be likened to a narrow strap with its edges turned in more or less. This part may be called the "flume," as it

no doubt serves as a way or channel for the spermatozoa. It is always spined, and in five different ways, as follows:—

1. At the base of the capsule and anterior end of the flume, the intermediate portion being straight-edged, with no spines.
2. At the base of the capsule and down one side of the flume.
3. At the base of the capsule and down both sides of the flume.
4. None at base of the capsule, but down both sides of the flume.
5. Spines on side of capsule; capsule elongate, pointed; flume short or broad, stout, and thickened into a sort of pouch.

The first four have a general uniformity, and the species examined include:—

Austenia gigas, Bs. (Plate XC. figs. 1–3.) Khasi.

Capsule long, basal processes cervicorn, few; the flume short, no marginal spines, subplumose spines at terminal end.

Austenia butleri, G.-A. (Plate XC. fig. 10.) Naga Hills.

Basal processes to capsule numerous.

Girasia hookeri, Gray, var. shillongensis, G.-A. (Plate LXXXVIII. figs. 1–1 *b*.) Khasi Hills.

Similar to *A. gigas*.

Austenia shanensis, G.-A. (Plate XCI. fig. 3 *c*.) Burmah.

Also like *A. gigas*.

Mariælla (=Dekhania) dussumieri, Val. (Plate XCIII. figs. 1 *b*, *c*.) Mysore.

Capsule moderately long, cervicorn processes at base of it; flume long, with no spines, single plumose branchlets at the base.

Macrochlamys udus, n. sp., G.-A. (Plate XCIV. fig. 1.) Assam Hills.

Spines on flume; single and double short spikes.

Macrochlamys flemingi, Pfr. (Plate LXXXVII. figs. 2–2 *d*.) Murree Hills, Punjab.

The capsule very long; spines on both sides of flume.

Macrochlamys pedina, Bs. (Plate LXXXIII. figs. 5–5 *c*.) Bombay.

Capsule very long; flume of great length, branched on both sides; spines blunt and stout at base of capsule; the rest are bifid twigs, springing from a single basal stem.

Bensonia labiata, Pfr. (Plate LXI. figs. 5 *e*–5 *g*.) N.W. Himalayas.

Capsule not seen complete; flume with spikelets close-set, short, and bifid.

Cryptosoma insusitatum, G.-A. (Plate LXX. fig. 8.) Eastern Burmah.

Capsule of moderate size, rounded at end; spines needle-like, wide apart.

Macrochlamys lecythis, Bs. (Plate XCIV. figs. 2, 2 *a*.) Cherra Poonjee, and in specimens from Lhota Naga and Khasi Hills.

Flume very long; spines thin, long, bifid, on both sides at base, and extending on one side for about halfway. Plate XCIV. fig. 4 is a small portion of basal end from another specimen, much magnified.

Stoliczka was the first naturalist to notice these structures in Indian Mollusca; he had then been dealing with soaked specimens, and had not formed any correct idea of their physiological and morphological value. He figures and describes two in Journ. Asiat. Soc. Bengal, vol. xl. pls. xvi. & xvii. pp. 243 & 250 :—

Sesara infrendens, Gould. (Plate xvi. fig. 7.) Moulmain.

Long spines down the whole length of one side only.

Macrochlamys honesta, Gould (? *andersoniana*, Nevill), Journ. Asiat. Soc. Bengal, vol. xlvi. pt. 2, p. 16 (1877). (Plate xvii. fig. 13.) Upper Burmah.

Spines on both sides at basal half of flume.

Stoliczka says he examined Dr. Anderson's specimens from Upper Burmah, which he then considered to be the same as the Moulmain shell described by Gould. Nevill afterwards named it as above, and as a variety of *honesta*. The type came from Ponsee; the shells from Assam, included by him in his Hand-list, p. 24, are, I consider, distinct.

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The following examples were imperfect :—

Kaliella kezamaensis, G.-A. (Plate XL. fig. 11.) Anghami Naga Hills.

Small bifid spikelets on one side of the flume.

Macrochlamys jainiana, G.-A. (Plate XXVIII. figs. 2 *b–e*.) Manbhum.

Capsule not seen perfect; spikelets on both sides, long and bifid.

Macrochlamys ? terminus, n. sp., G.-A. (Plate XCIV. figs. 3, 3 *a*.) Brahmakund, Eastern Assam.

Very close, regular, saw-like teeth down one side; capsule not seen. Requires verification.

Those in No. 5 show a certain modification in their form :—

Macrochlamys kala, G.-A. (Plate XL. figs. 6 & 7.) Bhutan Hills.

The capsule is studded on one side with short bifid spines; the flume is much enlarged, broad, with minute spines at the basal end. It is seen, in fig. 6, in process of development within the male organ.

Nilgiria tranquebarica, Fabr. (Plate LXXXI, figs. 3 *c*, 3 *d*.) Madras.

Capsule elongate; flume short, spikelet in bunches of four short equal spikes, on one side.

During development its shape is, however, very different (see Plate XCIV. figs. 5–5 *e*). It is very much shorter, the spines are closer together, and the long capsule, as seen in the spermatophore, is now short and bulbous (figs. 5 *b*, 5 *c*). In its passage through the main duct of the male organ such a soft pliant structure would undergo, I imagine, considerable gradual pressure and be stretched out. In fig. 5 *d* may be seen the junction of the vas deferens, with the position of the spermatophore indicated by the points of the spines lying just below the muscular covering of the flagellum. When a glass slide was placed over this and gentle pressure brought upon it, the spines all came into view, as shown in fig. 5 *e*, and on reversing the slide the flume and capsule only were seen, shutting out the view of the spines. The spiral form of the flume is due, of course, to contraction in spirit, and allowance must be made for this in all these drawings.

In a fresh specimen the spermatophore could be removed entire; but in this case it is so strongly bedded in the muscular envelope and hardened by the alcohol, I failed to do so. Still the exact position it occupies while developing is pretty clearly made out, and enables us to understand the figures illustrating the next species.

Euplecta binoyaensis, G.-A. (Plate XCVII. figs. 1 *b*, 1 *c*.) Ceylon.

The pouch-like flume has short bifid spines down one side; these near the capsule become longer in branched pairs, springing from one point; they become very minute towards the top of the capsule*.

Euplecta partita, Pfr. (Plate LXXXVII. figs. 1 *a*, 1 *b*, 1 *c*.) Ceylon.

This is probably of same type.

Ariophanta lævipes, Müller. (Plate LXXX. fig. 5 *b*.) Bombay.

The spermatophore seen in process of formation seems of this type so far as could be made out, and is placed here until it can be obtained in its full development.

* *Euplecta hyphasma.*—During the past month, while these pages have been passing through the press, I have been able to locate this species by the dissection of specimens sent me by Mr. O. Collett. The spermatophore is similar to that of *E. binoyaensis.*

Having referred to two species not before described, I must do so now, although they belong to a group I propose to include in another part of this work.

## Genus Macrochlamys.

(*Continued from* Vol. I. p. 216.)

Shells of moderate size (as *lecythis*); conoid or depressedly conoid, with glassy surface, in some cases microscopic longitudinal striation visible.

### Macrochlamys udus, n. sp.

*Locality.* Hengdan Peak, Burrail Range, Assam.

Shell very narrowly umbilicated, almost closed in some specimens, very depressedly conoid; sculpture very smooth, glassy, with longitudinal, regular, fine, microscopical striæ; colour pale olivaceous umber-brown; spire flatly conoid, apex convex; suture shallow; whorls 6, compressed, closely wound, sides convex, rounded at periphery; aperture lunate, directed downwards, subvertical; peristome thickened, particularly at the umbilical margin, which is oblique and straight and much sinuate.

Size: maj. diam. 8·8, min. diam. 8·0; alt. axis 4·0 mm.
,, 9·2, ,, 8·3; ,, 4·2 ,,

In a large series there is some slight variation in the height of the spire.

I have two specimens from the south face of the Garo Hills. It was abundant on Toruputu Peak, Dafla Hills. The finest specimens are from the Burroi Gorge, base of the same hills: 10·2 × 9 × 4·3 mm.

Examples from these localities are nearly imperforate; in other respects there is no difference to be found.

From Munipur I have a dwarf form with a higher spire, producing a more conoid rounded apex. A similar small but discoid form was very common at Kohima, in the Anghami Naga Hills, 6·5 mm. in major diameter. Only two from the Khasi Hills are in the collection, and these are small.

Soaking a few specimens resulted in obtaining two spermatophores in excellent preservation. One is figured on Plate XCIV. fig. 1. It has a long chitinous flume or gutter tapering towards the membranous capsule, which is rounded at the posterior end. The anterior end of the flume is set on both sides with a series of regularly distributed, thick, short, pointed processes, curving backwards, and more of these occur down one side than the other. At the basal end these processes are bifid on a short stem.

### Macrochlamys? terminus, n. sp.

*Locality.* Brahmakund, Eastern Assam (*M. T. Ogle*).

Shell perforate, glassy, smooth, depressedly conoid, flat on base; sculpture, no longitudinal striation; colour dark horny, greyish tint; spire rather low, side convex; suture adpressed, shallow;

whorls 6, small and closely wound near apex, somewhat convex; aperture lunate, directed laterally downwards; peristome thin, sinuate below, obliquely descending at columellar margin and very slightly reflected.

Size: maj. diam. 12·5, min. 11·3; alt. axis 5·4 mm.

*Animal.* Has a right shell-lobe, and the mucous gland an overhanging hooked process, well seen in a soaked-out specimen.

The jaw has a strong central projection, and the radula is like that of typical *Macrochlamys.*

In another specimen the curious shaped spermatophore (or what I take to be such), figured on Plate XCIV. fig. 3, was seen and mounted on a slide; it is shown as it appeared squeezed out of the spermatheca. I have lately soaked out two more specimens, but in neither did I find it again: the form is so abnormal that verification is necessary; we must not be too sure of these microscopic objects in specimens treated in this way.

Mr. Ogle obtained it also in the Diyung Valley, Singpho Hills, Mr. Chennell sent it to me from the Lhota Naga Hills, and I found it myself originally in the North Cachar Hills.

These shells will be duly figured in another Part with other glassy forms of the genus, such as *lecythis*, *honesta*, &c., together with the anatomical details, which are ready.

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On nearing the completion of another Part, I must acknowledge the title of this work lays me open to criticism. It was my original intention to include the Freshwater Molluscs, and in the Prospectus, referring to the 'Conchologia Indica,' I promised to "include species not published in that work and the numerous species that have since been discovered." I have only partially succeeded. As time went on, the acquisition of a large number of species preserved in alcohol belonging to the family Zonitidæ has led to far more illustration of anatomical details in this family alone than I ever anticipated. Although these plates will not interest so many individuals as plates of new species of shells would have done, yet I have felt detail to be much more important and I trust of more use towards solving questions of relationship and distribution.

There still remain to be examined very many species even in this family from Darjiling and Assam, Central India and Ceylon, the Andamans, &c. Several families have not been dealt with, only a few dissections have been made in the Helicidæ; happily, Mr. H. A. Pilsbry has been at work at some of the Eastern genera, and figured the genitalia and teeth of the radula. The Zonitidæ yet remain the least known group, especially the minute forms.

I well know how vast the area of British India is, yet I think the majority of naturalists will agree with me, the limit of political boundaries cannot be tolerated. However, one of my critics, writing

in "a very supercilious tone," has taken me to task for overstepping it, to describe species from Malayana, Africa, the West Indies, &c. My reply to him is this: I have, so far as my limited education in Natural History has gone, tried to raise the ordinary standard of much of the molluscan work in this country to something more than mere shell descriptions; but because I have included studies of forms beyond the Indian borders to elucidate those within, I am chided, and the reviewer thinks fit to be amusing at my expense by mentioning Timbuctoo—I presume as a typical, out of the world spot. I trust, however, the naturalist who may hereafter be engaged on the molluscan affinities of Timbuctoo and the Lake Chad country will not neglect to notice whether any Abyssinian or West-African forms extend into that area, and show how it may be connected with Somaliland, Socotra, and India. This narrow-minded kind of criticism would equally condemn the writers of a "Revision of the North-American Slugs" for alluding to the Himalayan genus *Anadenus*, one of the most interesting points in their paper. It becomes impossible to limit the area of observation. Animal life from the earliest times has been changing locally, and travelling insensibly in different directions over vast segments of the earth's surface: the chief interest in its study centres in how the creatures of one segment, in this case snails and slugs, differ in their organization from those of another segment. Following on this comes the Geological History of the great segments, and how and when they were probably connected or separated.

In Natural History we have to take all we can get, or we should do so. So long as we studied nothing beyond the shell, particularly fossil forms, workers were restricted to conchology, the limits of which were more conveniently and naturally circumscribed, often to the contents of a single geological horizon; and as a knowledge of the animals increased, so much the more could past physical features be intelligently read. When we are in possession of the animal, and begin looking into anatomical differences, I see no other way in which such study can be made both interesting and instructive than by a liberal supply of drawings of the animals living (described in this work) within the bounds of India, placed side by side with those most nearly like them, or unlike them, the tenants of countries outside it. It is quite immaterial whether the distance dividing them be half the circumference of the earth or Timbuctoo itself. If this investigation were only to prove all the species to be similar something would have been gained, and we should come to the end of our work; fortunately the results are in the opposite direction, and leave us some most absorbing points to ponder on.

Malacologists are not a numerous body, and for this very reason it has been my endeavour, so far as my labours of hand and eye can go, to render the work to some extent useful not only to naturalists in India but to those who may be carrying on similar investigations in Africa, Australia, and other parts of the world. There is still very much to be learnt as to the actual extent of the area over which so many species are to be found, and draw a line round it. Take the

Indian region: we know many species to extend along certain strips of the mountain masses, but in the case of very few can we at present define both ends of such strips. We only know that within certain limits a considerable change in the molluscan fauna takes place. A great deal of accurate observation of this kind has still to be made, much more material preserved in spirit is required, and many hours of work must be gone through, before we shall be able to place many a species in its true generic position.

As to the inaccuracies pointed out by my critic, I have nothing to complain of, and am glad they are referred to; it is a healthy thing to be found fault with. It is a very moot point whether the discovery of *Bulimus* of Scopoli being a freshwater form and its suppression have been of any utility to conchologists. *Bulimus* had "taken hold" and been in universal use by many writers for a great main group of shells, and it is difficult to throw off the idea it has conveyed for years. In making changes like this, some consideration should be made for views held by the early writers and how a term grew into use. However, the same puzzle meets the ornithologist, and this is not the place to revive such a controversy. Moreover, it is very difficult for those who began collecting long ago to think of *Bulimus* as an inhabitant of fresh water.

As to classification, the time has really not arrived when it should be attempted; although many thirsty souls are eager to see it finished, it should be put off until we know more about the many and even large species awaiting examination, such as *basileus*, *basilessa*, *ampulla*, *saturnia*, &c. In my address to the Malacological Society I ventured upon the phylogeny of the Macrochlamidæ; but even here the position of *Macrochlamys pedina* cannot be accepted as final, on account of the similarity of its genitalia to the type of the Ariophantinæ. A comparison of Indian genera is necessary with those which have been founded during the past few years by naturalists who have been doing good work in the Malay Archipelago, China, &c., among whom I may mention O. v. Möllendorff, E. v. Martens, L. Pfeffer, P. and F. Sarasin, &c.

For a very considerable portion of the contents of this Part, and the light it throws on the morphology of the Indian Land Mollusca, I am indebted to the active interest and assistance of Mr. O. Collett, who has sent me so many species, beautifully preserved, from Ceylon. He and Mr. Preston have given quite an impetus to the study of the Indian species, and we have had valuable papers from Mr. E. R. Sykes on these collections. To Mr. Phipson, of Bombay, both direct and through Mr. W. T. Blanford, I am also under obligation for species in alcohol. Major Thurston, of the Madras Museum, and Lieut. Stanley Flower, in Siam, have also sent me some species of much interest, for which my best thanks are due.

In conclusion, I may add, I have been able of late to determine the generic position of the following Ceylon and one South-Indian species:—*Microcystis*? *thwaitesi*, Pfr. = *suavis*, Jousseaume, and *Macrochlamys*? *circumsculpta*, Sykes, both belong to *Philalanka*; I also find that *Thysanota crinigera*, Bs., *biciliata*, Pfr., and *hispida*,

Sykes, are closely allied to this genus. The anatomy on the whole is characteristic of genera inhabiting islands of the southern hemisphere.

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## EXPLANATION OF PLATE LXXXIII.

*Macrochlamys pedina*, Benson. Bombay.

Fig. 1. Shell- and mantle-lobes detached, × 4.
2. Generative organs detached, × 4. *crp*, *cæcum musculi retractoris penis* of Semper.
2 *a*. Ditto, hermaphrodite-duct and albumen-gland, × 4.
3. Male organ coiled as in nature, × 4.
3 *a*. Ditto, part near the retractor muscle attachment opened out, showing cæcum, × 8.
4. Amatorial organ, showing the papilla, × 8.
4 *a*. Ditto, the amatorial rod opened out, × 8.
4 *b*. Ditto, section through the amatorial organ near the middle, × 4·5.
5. Spermatophore, entire, from the spermatheca, × 4·5.
5 *a*. Ditto, portion at base of capsule, × 30.
5 *b*. Ditto, portion near middle of flume, × 30.
5 *c*. Ditto, head of the capsule, × 24.

## EXPLANATION OF PLATE LXXXIV.

*Eurychlamys platychlamys*, W. T. Blf. Bombay.

Fig. 1. Animal, viewed from right side, showing the mantle-lobes, × 4·5.
1 *a*. Left side, ditto, × 4·5.
1 *b*. Shell, × 2·4.
1 *c*. Jaw, × 12.
1 *d*. Generative organs, × 4.
1 *e*. The male organ from another specimen, × 12.

*Eurychlamys regulata*, Benson. Ceylon.

Fig. 2. Animal, viewed from the right side, × 4·5. *r.s.l*, right shell-lobe turned down (inside surface of).
2 *a*. Ditto, right side, × 2. Right shell-lobe in true position.
2 *b*. Shell, × 2·4.
2 *c*. Sculpture of shell near suture, × 30.
2 *d*. The shell- and mantle-lobes detached from the animal, × 4.
2 *e*. Jaw, × 12.
2 *f*. Central and median teeth of radula, × 368.
2 *g*. The male organ and portion of genitalia, × 8.

## EXPLANATION OF PLATE LXXXV.

*Ratnadvipia irradians*, Benson. Ceylon.

Fig. 1. Animal, view of right side showing the shell- and mantle-lobes, × 2·5.
2. Shell- and mantle-lobes, left side, × 2·4.
3. Sole of foot showing the medial fold and segmentation, × 4·5.
4. The buccal mass, × 4.
5. Shell from above, × 2·5.
5 *a*. Ditto, side view, × 2·5.
6. Part of the genitalia: male and amatorial organs, × 2·5.
6 *a*. Male organ, another view, × 2·5.
7. Jaw, × 8.
8. Teeth of radula, central and median, × 368.
8 *a*. Ditto, outermost laterals, × 368.

## EXPLANATION OF PLATE LXXXVI.

*Euplecta præeminens*, Sykes. Ceylon.

Fig. 1. Animal viewed from the right side, shell removed; point of amatorial organ is seen projecting from the generative aperture, × 2·4.
2. Shell- and dorsal lobes, × 4·5.
3. Extremity of foot, viewed from behind, × 8.
4. Genitalia, male and amatorial organ, × 4·5. *crp*, *cæcum musculi retractoris penis* of Semper.
4 *a*. Male organ, from another side, × 4·5.
4 *b*. Ditto, ditto, × 4·5.
4 *c*. Uterus, oviduct, and vas deferens, × 4·5.
5. Jaw, × 8.
6, 6 *a*, 6 *b*. Teeth of radula, × 368.
7. Portion of shell showing sculpture, × 30.

## EXPLANATION OF PLATE LXXXVII.

*Euplecta partita*, Pfr. Ceylon.

Fig. 1. Generative organs, × 4·5. *crp*, *cæcum musculi retractoris penis* of Semper.
1 *a*. Male organ, from another side, × 4·5.
1 *b*. Part of, showing position of spermatophore in process of formation, × 8.
1 *c*. Ditto, ditto, × 8.
1 *d*. The dorsal lobes, × 4.
1 *e*. Buccal mass and salivary glands, × 4·5.

*Macrochlamys flemingi*, Pfr. Murree, Punjab.

Fig. 2. Spermatophore, × 4·5.
2 *a*. Ditto, part of, still further enlarged, × 24. *a*, *b*, *c*, spines of.
2 *b*. Ditto, posterior end of capsule, × 30.
2 *c*. Ditto, spines of (*a′*, *b′*), × 30.
2 *d*. Ditto, a single spine (*c′*), × 30.

## EXPLANATION OF PLATE LXXXVIII.

*Girasia hookeri*, Gray, var. *shillongensis*, G.-A. Khasi Hills.

Fig. 1. Spermatophore (=fig. 8, pl. xxvii. P. Z. S. 1880), × 4.
1 *a*. Ditto, basal fronds (=fig. 8 *a*, pl. xxvii. P. Z. S. 1880), × 20.
1 *b*. Ditto, ditto (=fig. 8 *b*, pl. xxvii. P. Z. S. 1880), × 50.
1 *c*. Underside of foot, showing the segmentation of the mass (=fig. 5, pl. xxvii. P. Z. S. 1880).

*Girasia hookeri*, Gray. Khasi Hills.

Fig. 2. Side view of animal showing the main retractor muscles and site of their several attachments, nat. size.
2 *a*. Side view, showing same, nat. size.
2 *b*. View from beneath of upper wall of the body-cavity, showing the several muscle attachments, nat. size.
2 *c*. Ditto, showing position of heart, pulmonary cavity, &c., nat. size. *m*, edge of mantle.
2 *d*. Sole of foot, lower floor of body-cavity, with muscle attachment of buccal mass, B*p*, nat. size.
2 *e*. The visceral sac, shell removed, viewed from above, × 2·5.
2 *f*. The visceral cavity from above, showing convolutions of the intestine and position of adjacent organs, × 2·5.
2 *g*. The stomach with salivary glands, nat. size.

Fig. 2 *h*. The anterior end of the dart, × 4.
2 *i*. Posterior bend of male organ with retractor-muscle attachment, × 2.

B, Buccal mass; *Bcdm*, central dorsal muscle of buccal mass; *Brdm*, right dorsal muscle of same; *Bldm*, left ditto; B + *l*E, left eye-tentacle united with that of buccal mass; B*p*, pedal and buccal mass; D, amatorial organ; *hd*, hermaphrodite-duct; *Al.gld*, albumen-gland; *i*, intestine; *a*, anus; *m*, mouth; *Sal.gld*, salivary gland; *Pul.cav*, pulmonary cavity; *r*, renal organ; P + *r*E, right eye-tentacle united with that of the male organ; *l*, liver.

## EXPLANATION OF PLATE LXXXIX.

*Austenia gigas*, small var. Khasi Hills.

Fig. 1. Generative organs, side view, different parts in relative position (= fig. 1, pl. xxv. P. Z. S. 1880), × 2.
2. Ditto, viewed from above (= fig. 2, pl. xxv. P. Z. S. 1880), × 2.
3. Ditto, removed from the animal (= fig. 3, pl. xxv. P. Z. S. 1880), × 2.
4. Œsophagus, mucous gland, and anterior loop of the vas deferens showing position of (= fig. 4, pl. xxv. P. Z. S. 1880).
5. The amatorial organ cut open, exposing the muscular dart or rod, much enlarged (= fig. 7, pl. xxvi. P. Z. S. 1880).

*Al.gd*, albumen-gland; *Bcdm*, central dorsal muscle of buccal mass; (*Brd*)*m*, *m*(*Bld*), right and left dorsal muscle of same; D, dart-sac or amatorial organ; *rmD*, retractor muscle of same; *lEt*, left eye-tentacle; *H.ap*, hermaphrodite aperture; *rmP*, retractor muscle of penis or male organ; *Pa*, anterior end of same; *Pc*, posterior end of same; *Pd*, junction of vas deferens; *K*, cæcum calciferum or kalk-sac; *Sp*, spermatheca; *Sal.gld*, salivary gland; *Sal.dt*, salivary duct: *a* and *d*, minor ducts to the stomach; *st*, stomach; *i*, intestine; *vd*, vas deferens; *vag*, vagina; *ov*, oviduct; *mu.gd*, mucous gland; *m*, muscular band.

## EXPLANATION OF PLATE XC.

For a description of the anatomy, see Vol. I. pp. 229-232.

*Austenia gigas*, Bs. Teria Ghat.

Fig. 1. The male organ, showing the position *in situ* of the spermatophore in its passage outwards (= fig. 2, pl. xxvi. P. Z. S. 1880), × 3.
2. Ditto, showing capsule filled with spermatic coil (= fig. 3, pl. xxvi. P. Z. S. 1880), × 4.
3. Ditto, spermatophores in the spermatheca, × 4.

*Austenia gigas*, small var. Khasi.

Fig. 4. Broken portion of spermatophore, much enlarged (= fig. 6, pl. xxiv. P. Z. S. 1880).

*Austenia butleri*, G.-A. Naga Hills.

Fig. 5. Shell (= fig. 9, pl. xxiv. P. Z. S. 1880), nat. size.
6. Shell-lobes and mantle-lobes (= fig. 1, pl. xxvi. P. Z. S. 1880).
7, 7 *a*. Teeth of radula (= fig. 10, pl. xxvii. P. Z. S. 1880), × 340.
8. Jaw (= fig. 9, pl. xxvii. P. Z. S. 1880), × 8.
9. Generative organs (= fig. 8, pl. xxvi. P. Z. S. 1880), nat. size.
10. Cervicorn spines of the spermatophore (= fig. 5, pl. xxvi. P. Z. S. 1880), × 20.

*rm*P, retractor muscle of the male organ; *vd*, vas deferens; *sp*, spermatheca (portion of the sac); *a*, *a'*, anterior end of male organ; *b*, base of capsule of spermatophore; *c*, junction of retractor muscle; *d*, junction of vas deferens; *e*, end of kalk-sac; *f.ov*, part of free oviduct; *rsl*, *lsl*, *ldl*, right and left shell and dorsal lobes respectively.

## EXPLANATION OF PLATE XCI.

*Austenia gurhwalensis*, n. sp. Gurhwal.

Fig. 1. Shell, front view, × 2·4.
1 *a*. Ditto, from above, × 2·4.
1 *b*. Sculpture of, on body-whorl, × 58.
1 *c*. Jaw, × 8.
1 *d*. Central teeth of radula, × 368.
1 *e*. 22nd, 23rd, and 24th median teeth, × 368.
1 *f*. 26th, 27th, and 28th lateral teeth, × 368.
1 *g*. Outermost laterals, × 368.
1 *h*. The amatorial organ, × 4.

*Austenia paurhiensis*, n. sp. Gurhwal.

Fig. 2. Shell, front view, × 2·4.
2 *a*. Ditto, from above, × 2·4.
2 *b*. Animal with shell removed, right side, showing mantle-lobes, × 4.
2 *c*. Ditto, left side, showing mantle-lobes, × 4.

*Austenia shanensis*, n. sp. Shan States.

Fig. 3. Shell, from above, × 2·4.
3 *a*. Ditto, from below, × 2·4.
3 *b*. Animal from right side, portion only well preserved, × 2.
3 *c*. Spermatophores, × 8.
3 *d*. Lateral teeth of radula, × 368.
3 *e*. Outside laterals, × 368.

*Austenia planospira*, Bs. Sikkim.

Fig. 4. Anterior end of the amatorial organ, × 12.

## EXPLANATION OF PLATE XCII.

*Microcystina lita*, Sykes. Ceylon.

Fig. 1. Shell, from type, × 8.
1 *a*. Surface of shell, × 58. *s*, suture.
1 *b*. The spiral of the whorls, × 4·5.
1 *c*. The columellar margin and umbilical region, × 24.

*Microcystina lita*, juv. Ceylon.

Fig. 2. Shell, × 8.
2 *a*. Surface of shell, × 58.
2 *b*. The spiral of the whorls, × 4·5.
2 *c*. The umbilical region, showing columella, × 24.

*Microcystina perfucata*, Bs., var. *bintennensis*. Bintenne, Ceylon.

Fig. 3. Shell, × 4·5.
3 *a*. Surface of shell, × 58.
3 *b*. The umbilicus and columellar margin, × 24.
3 *c*. Animal, shell removed, showing foot and dorsal lobes, × 8.
3 *d*. Right shell- and dorsal lobes, × 24.
3 *e*. Left dorsal lobes, × 24.
3 *f*. Side view of foot, × 12.
3 *g*. The male organ, × 24.
3 *h*. Ditto, under pressure in transmitted light, × 58.
3 *i*. Buccal mass of intestine and salivary glands, × 12.

*Microcystina perfucata*, Benson.

Fig. 4. Columella, × 24.

## EXPLANATION OF PLATE XCIII.

*Mariælla* [= *Girasia* (*Dekhania*) of Vol. I.] *dussumieri*, Val. (black specimen). Mysore.

Fig. 1. Shell, from above, × 2·5.
1 *a*. Generative organs, × 2·5.
1 *b*. Spermatophore, × 4·5.
1 *c*. Ditto, basal end, × 12·4.

*Mariælla* [= *Girasia* (*Dekhania*) of Vol. I.] *dussumieri*, Val. (a dark olivaceous-green specimen).

Fig. 2. Animal, view of right side, × 2·4.
2 *a*. Ditto, from above, × 2·4.
2 *b*. Shell, 2·5.
2 *c*. Ditto, × 4·5.

*Microcystis? ambæ*, n. sp. Ceylon.

Fig. 3. Shell, front view, × 12.
3 *a*. Ditto. from above, × 8.
3 *b*. Sculpture, × 58.
3 *c*. Head of animal *, × 24.
3 *d*. Extremity of foot †, × 24.
3 *e*. Teeth of radula, × 368.
3 *f*. Embryonic shells in the uterus, × 12.
3 *g*. Ditto, one enlarged, × 24.
3 *h*. An embryo, showing stage of development, × 58. *a*, ?anal aperture; *Res.ap*, ? the respiratory ditto.

*Kaliella delectabilis*, Sykes. Ceylon.

Fig. 4. Sculpture, × 58.

## EXPLANATION OF PLATE XCIV.

Fig. 1. *Macrochlamys udus*, n. sp.: spermatophore, much enlarged. Burrail Range, Assam.
2. *Macrochlamys lecythis*, Bs.: spermatophore, much enlarged. Cherra Poongee, Khasi Hills.
2 *a*. Ditto: the capsule of the spermatophore, less enlarged.
3. *Macrochlamys? terminus*, n. sp.: spermatophore, × 52. Brahmakund, Assam.
3 *a*. Ditto: ditto, × 20.
4. *Macrochlamys lecythis*, Bs., part of a spermatophore, much enlarged. Naga Hills.

[The shells of Nos. 1, 2, and 3 will be figured in a future Part.]

*Nilgiria tranquebarica*, Fabr. Madras.

Fig. 5. View of side of the kalk-sac, showing position of the spikelets, × 12·5.
5 *a*. View of inner end.
5 *b*. Showing the capsule.
5 *c*. The same under slight pressure, showing the capsule and flume; spikelets on the other side.
5 *d*. View of the reverse side, to show junction of the vas deferens; the spikelets just indicated on the surface.
5 *e*. The same under slight pressure and in strong light, showing the flume and its spines.

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* Eye-bearing tentacles decayed.
† State of preservation did not admit of seeing any mucous gland.

## EXPLANATION OF PLATE XCV.

*Bensonia jacquemonti*, var. *kurramensis*, G.-A. Kurram Valley, N.W. Frontier.

Fig. 1. Animal, drawn from life, nat. size.
1 *a*. Ditto, ditto, from left side.
1 *b*. Extremity of foot showing mucous gland, from life, enlarged.
1 *c*. Ditto, side view, enlarged.
1 *d*. Dorsal lobes, as seen detached from the animal, × 4.
1 *c*. Male organ, × 8.
1 *f*. Spermatheca, oviduct, &c., × 8.
1 *g*. Amatorial organ, × 8.
1 *h*. Outermost teeth of the radula, × 360.
1 *i*. Shell, × 1·6.

*Bensonia wynnei*, W. T. Blf.

| | | |
|---|---|---|
| Fig. 2, 2 *a*. | × 1·5 and × 1·2. | Cherat, Kuttak Hills. |
| 2 *b*. | Nat. size. | Ditto. |
| 3. | × 2·2. | Typical locality, Murree. |
| 3 *a*. | Nat. size. | Ditto. |

## EXPLANATION OF PLATE XCVI.

*Nilgiria chenui*, Pfr. Ceylon.

Fig. 1. Anterior part of animal, from right side, showing mantle-lobes and dermal channels, × 2·3.
2. Ditto, from the right side, × 2·3.
3. Extremity of foot, side view, × 2·3.
4. Ditto, viewed from behind, showing mucous pore, × 2·3.
5. Generative organs, nat. size.
6. Male organ, × 2.
7. Ditto, × 4·5.
8. Central teeth of the odontophore, × 196.
8 *a*. Median teeth of ditto (20th to 25th), × 196.
8 *b*. Lateral teeth, × 196.
8 *c*. Outermost laterals, × 196.
9. Jaw, × 8.

## EXPLANATION OF PLATE XCVII.

*Euplecta binoyaensis*, n. sp. Ceylon.

Fig. 1. Shell, × 4·5.
1 *a*. Sculpture of last whorl near suture, × 58.
1 *b*. Portion of generative organs, showing spermatheca in process of formation, × 12·5.
1 *c*. Spermatophore, × 24.
1 *d*. Amatorial organ, × 12·5.

*Euplecta semidecussata*, Pfr. Ceylon.

Fig. 2. Portion of generative organs, × 4·5.
2 *a*. The male organ from another side, × 4·5.
2 *b*. Part of the genitalia. *x*, ovitheca.
2 *c*. Odontophore, transition teeth and first laterals, × 195.
2 *d*. Jaw, × 8.

## EXPLANATION OF PLATE XCVIII.

*Nilgiria ligulata*, Férussac. Madras.

Fig. 1. Animal, view of right side, × 2.
1 *a.* Right side of mantle-zone, with right dorsal lobe, × 4·5. *rec*, rectum.
1 *b.* The mantle-zone, with right and left dorsal lobes, × 4·5.
1 *c.* Genitalia, × 4·5. *ot*, ovitheca.
1 *d.* Sculpture of shell on penultimate whorl, × 4·5.

*Nilgiria tranquebarica*, Fabr. Madras.

Fig. 2. Oblique cut through the ovitheca, showing internal rugæ, × 12·5.
2 *a.* Same above the cut, × 12·5.
2 *b.* Sculpture of shell on last and penultimate whorls, × 4·5.

*Nilgiria chenui*, Pfr. Ceylon.

Fig. 3. Sculpture of shell 22 mm. behind the aperture, × 4·5.

*Ariophanta dalyi*, W. T. Blf., subsp. (*A. cysis*, var.) Mysore.

Fig. 4. Genitalia, × 4·5.

*Euplecta semidecussata*, Pfr. Ceylon.

Fig. 5. Sculpture of shell, last whorl, × 8.

## EXPLANATION OF PLATE XCIX.

*Haughtonia conferta*, Pfr.

Fig. 1. The animal, viewed from the right side, × 2·2.
2. The mucous pore, seen from behind, × 8.
3. The mantle-edge and dorsal lobes, detached, × 2.
4. The mantle-edge in vicinity of the respiratory aperture, showing the rudimentary right shell-lobe, × 9.
5. Genitalia, × 2·5.
5 *a.* The male organ, from two different sides, × 4·5.
5 *b.* Ditto, with lower muscular sheath cut open, × 8.
6. The centre teeth of the radula, × 365.
6 *a.* The median at the 20th tooth to the 25th lateral, × 365.
6 *b.* The outermost laterals, × 365.
7. The jaw, × 8.
8. Sculpture of the shell, × 24.

## EXPLANATION OF PLATE C.

*Khasiella vidua*, W. T. Blf. Munipur Hills.

Fig. 1. Animal, from the right side, mantle-zone removed, × 4·5. *i*, intestine; *b*, integument covering branchial chamber.
1 *a.* Extremity of the foot, × 4·5.
1 *b.* Mantle-zone removed, showing right and dorsal shell-lobes, × 8.
1 *c.* Ditto, showing the left shell- and dorsal lobes, × 8.
2. Shell, × 3.
2 *a.* Portion of shell, to show the costulation, × 8.
3. Genitalia, × 4·5.
3 *a.* The cæcum of the male organ, × 8.
4. Jaw, × 24.
5. Centre tooth and adjacent medians, × 365.
5 *a.* 14th to 19th teeth, × 365.
5 *b.* 20th to 23rd lateral teeth, × 365.
5 *c.* Ditto, × 365.
5 *d.* Outermost or marginal teeth, × 365.

# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA,

INCLUDING

SOUTH ARABIA, BALUCHISTAN, AFGHANSTAN,
KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM,
MALAY PENINSULA, CEYLON, AND OTHER
ISLANDS OF THE INDIAN OCEAN.

SUPPLEMENTARY TO MESSRS. THEOBALD AND HANLEY'S

CONCHOLOGIA INDICA.

BY

Lieut.-Colonel H. H. GODWIN-AUSTEN,
F.R.S., F.R.G.S., F.Z.S., &c.,

LATE DEPUTY SUPERINTENDENT TOPOGRAPHICAL SURVEY OF INDIA, IN CHARGE OF
THE KHASI, GARO, AND NAGA-HILLS SURVEY PARTY.

Vol. II.

**Part X.—APRIL 1907.**

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# LAND AND FRESHWATER MOLLUSCA

OF

# I N D I A.

## VOL. II.

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**Part X.—APRIL 1907.**

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(Plates CI.–CXVII.—*April* 1907.)

Family ZONITIDÆ.

(*Continued from* Vol. II. p. 140.)

Genus Bensonia.

(*Continued from* Vol. II. p. 120.)

Bensonia camura, Benson. (Plate CI. figs. 1–7.)

*Helix camura*, Benson, Ann. & Mag. N. H. 1859, vol. iii. p. 269; Pfr. Mon. Hel. vol. v. p. 180; id. Malak. Blätt. 1859, p. 23. no. 683 *a*.

*Helix* ——, Hanley, Conch. Ind. p. 26, pl. lv. fig. 2 (good figure).

*Macrochlamys camura* (sec. B), Theob. Suppl. Cat. p. 18.

*Nanina camura*, Nevill, Hand-list, p. 30.

*Hemiplecta* (sec. C. Carinatæ) *camura*, Clessin, Nomencl. p. 52.

Original description:—"*Testa* [figs. 1, 1 *a*] *anguste umbilicata, conoideo-depressa, oblique rude rugoso-plicatula, sub lente minutissime granulata, subtus læviori, translucente, cornea; spira depresso-conoidea, lateribus planulatis, apice acutiusculo, sutura leviter impressa, junioris marginata; anfractibus* $6\frac{1}{2}$, *vix convexiusculis, ultimo compresse carinato, subserrulato, subtus convexo; apertura*

absent. The retractor muscle of the male organ (fig. 4 *a*) is given off from the head of a large ovate swollen mass, which corresponds with the coiled mass seen in *Oxytes orobia*. There is a short flagellum or kalc-sac. The spermatheca is moderately long and consists of an ovate membranous portion situated on a lower thick muscular tube (fig. 4 *b*); the albumen-gland was small; the hermaphrodite duct extremely convoluted.

Jaw (fig. 5) with a large central projection.

The radula (fig. 6) has this formula:—

$$\begin{gathered}40\ .\ 2\ .\ 17\ .\ 1\ .\ 17\ .\ 2\ .\ 40\\ 59\ .\ 1\ .\ 59\end{gathered}$$

The central tooth is tricuspid, the admedians also tricuspid, the inner well developed and standing higher than the outer, which is the largest. The marginals are curved, bicuspid, the outer cusp below the inner.

Of this species there were only two specimens in the collection with similar sculpture on the shell—one an adult, from which the above description has been made, and the other a much younger example which I have left in the shell; the pallial margin and markings on the visceral sac are the same in both.

The anatomy of this animal is so very unlike any I am acquainted with, that I found it impossible to put it into any previously described genus of Indian land-shells, and I have therefore created a new subgenus for its reception.

I must call attention to a very interesting point connected with this species: it is so remarkably like another in its shell-character inhabiting the vicinity of the same peak, Richila. On the first sorting-out of a quart-bottle of shells from this locality I placed them together; on a second sorting I noticed considerable difference in the sculpture when this was looked at under a high power, combined with a modification in the form of the shell, of that indefinable nature one is so often confronted with in shells of this type. Finally, on dissection, one (*richilaensis*) was found to be a *Macrochlamys* with the characteristic shell-lobes; the other (*bhutanensis*), above described, had none, and, besides, very different genitalia with no amatorial organ, thus representing two quite distinct genera.

It will be interesting to see, when the land-shells of the Bhutan Himalaya are better known, whether on this line of longitude, 88°, we have entered the confines of a molluscan subregion distinct from that to the west and south of it, one more closely related to that of Western China. A Dafla form, of which I unfortunately had only one badly preserved animal to examine, presented anatomical characters differing very much from those we are well acquainted with. Taking the external characters, the absence of a mucous gland rendered it impossible to place it with certainty in any genus we at present know. This interesting species I describe further on.

## Genus Macrochlamys.

(*Continued from* Vol. II. p. 90.)

Macrochlamys tugurium, Benson. (Plate CIV. figs. 1–7.)

*Helix tugurium*, Benson, A. M. N. H. ser. 2, 1852, vol. x. p. 348; Pfr. Mon. Hel. vol. iv. p. 124; Reeve, Conch. Icon. t. 171. fig. 1151; Hanley, Conch. Ind. p. 14, pl. xxix. fig. 10.

*Rotula* (sec. A) *tugurium*, Theob. Suppl. Cat. p. 21.

*Nanina tugurium*, Nevill, Hand-list, p. 30. (Stoliczka's description of the animal quoted by G. Nevill is very accurate as regards the form of the extremity of the foot.)

*Bensonia tugurium*, Clessin, Nomen. Helic. p. 42.

Original description :—" *Testa perforata, depressa, tenui, supra exilissime radiatim costulato-striata, striis spiralibus decussatis, subtus lævigata, luteo-cornea; spira depresso-conoidea, apice acutiusculo. Anfractibus* 6, *planiusculis, ultimo ad periphæriam subcarinato, subtus convexiusculo; apertura obliqua, late lunari, intus remote albido-sublabiata, peristomate simplici, acuto, margine columellari breviter subreflexo.*

" Diam. major 19, minor 16, axis 10 mill.

" *Hab.* ad Darjiling. *Teste* R. Trotter.

" The sculpture of this species is peculiarly delicate and beautiful. The labiation near the aperture forms exteriorly a yellow band similar to those observable in several other Himalayan *Helices*, and in the species *H. verticillus* and *smyrnensis* of Southern Europe and Asia Minor."

*Macrochlamys tugurium* of Benson is one of the largest land-shells in the valley of the Teesta and its tributaries. It is a variable shell, for I have examples with a pale ochre band behind the aperture, a moderately high spire, and of a general greenish-grey tint; one very close-wound shell with a high spire from Stoliczka, one of a fine burnt-sienna and same coloured band from Nevill (?), four with pale ochre band and of a greenish-brown tint throughout; from the Richila Pass, Sikkim, I have a fine series depressed in form, the band at the peristome not so yellow in tint, more distinctly rosy brown. Specimens examined are as follows :—

| | | | Band near aperture. | Maj. diam. mm. |
|---|---|---|---|---|
| | *tugurium*: | type described by Benson | ...... | 19·0 |
| Decussate. | do. | from Rissom Peak ...... | Ruddy brown. | 18·75 |
| Do. | do. | from Richila Peak ...... | ,, ,, | 16 50 |
| Finely decussate. | do. | from Stoliczka ............ | Ochre. | 21·75 |
| Decussate. | do. | from Blanford ............ | ,, | 19·0 |
| | do. | from Nevill ................ | Brown. | 20·0 |
| | *dalingensis*, G.-A. (type) | ......... .. | ...... | 24·0 |
| | *mainwaringi* (type) | .................... | ...... | 27·0 |

The figure in the 'Conchologia Indica,' pl. xxix. fig. 10 (Reeve,

Conch. Icon. f. 1151), has too sharp an apex; in this position the band is not well seen, but it is indicated inside the aperture.

The first two or three whorls of the shell (Plate CIV. figs. 1, 1 *a*, 1 *b*) show hardly any sculpture, thence a very finely decussate surface gradually follows, becoming strong towards the aperture; under a high power the cross-striation produces a close series of papillate dots.

The living animal of this species was figured in Vol. I. Plate XIX. fig. 2 (1883), from a drawing made by a native artist under Ferd. Stoliczka's superintendence (No. 46). The mantle-zone is figured on Plate XX. figs. 3, 3 *a*, from a specimen in spirit collected by W. T. Blanford at Darjiling. I had not at that time examined the large collection made and sent to me by Mr. Robert of the Survey Department, so did not refer to the species in the text.

*Description of the animal.* A specimen from Rissom Peak in the Daling District, east of the Teesta, which prior to 1864 formed part of the Bhutan State (4600 feet), is as follows:—Ochre throughout; the pedal margin (Plate CIV. fig. 3) very wide, sole of foot divided into three equal areas, a very large overhanging lobe at the extremity of the foot. There is a large right shell-lobe (fig. 2) and a well-developed left shell-lobe: the right neck-lobe is small, the left neck-lobe rather narrow and succeeded after a short interval by another very small lobe close up to the left shell-lobe. The roof of the respiratory cavity (fig. 4) is mottled sparsely with black. In a full-grown specimen from the same locality the colour was ochraceous, the peripodial fringe and sole of the foot with a green tinge. When the shell is removed a broad black band is conspicuous near the rectum (*r*, fig. 4), the membrane of the visceral sac covering the branchial cavity is speckled and streaked all over, and one large longitudinal streak occurs on about the middle line; while the integument covering the renal organ is black, forming a second, more posterior, brownish streak (fig. 4). There is a long pointed lobe over the mucous gland (fig. 3). The right shell-lobe is large and tapering, the left is well developed, the dorsal lobes as before described.

The generative organs (figs. 5, 5 *a*, 5 *b*) were not found at their full state of development: the animals were taken in the winter months, still their state was quite sufficient to show all important characters. In the male organ (fig. 5 *a*) the retractor muscle is attached to a coiled cæcum and there is a moderately long flagellum. The amatorial organ is very long, also the spermatheca.

The jaw (fig. 6) has a central projection.

The teeth of the radula (fig. 7) are as is usual in the genus *Macrochlamys* as regards the centre tooth and admedians, the arrangement being as follows:—

$$\frac{33 \; . \; 2 \; . \; 12 \; . \; 1 \; . \; 12 \; . \; 2 \; . \; 33}{47 \; . \; 1 \; . \; 47}$$

The teeth from the 15th to the 18th inclusive have a cusp on the outer side below the point; this cusp becomes rapidly very

minute, and towards the margin the teeth are nearly aculeate, only a very minute notch indicating the cusp.

A closely allied species, larger and in other respects differing from *tugurium*, is *M. dalingensis*, described in Vol. I. p. 121, Plate XXXV. (Oct. 1883) of this work. This has recently been included in a paper by the late Dr. W. T. Blanford, 'Proceedings of the Malacological Society,' vol. iv. pt. 4, March 1901, "Note on *Bensonia mainwaringi* and *Macrochlamys dalingensis*." He particularly points out the peculiar character of a labiate aperture at different stages of growth presented in *Bensonia monticola* and *Helix celox*, Benson, MS., and he relates why the latter was never described. Fortunately the typical shell of *H. celox* is in Dr. Blanford's collection and he was able to show it to be the same as one to which Nevill attached the name *mainwaringi*; he obtained this from Darjiling and named it after Colonel Mainwaring, its collector. Mr. Nevill also wrote the same name on a drawing of Stoliczka's of a Darjiling species, and I am responsible for having first put Nevill's MS. name *mainwaringi* into print. I now feel certain that the shell of the animal figured by Stoliczka cannot be connected with the shell sent to me some six years after by Nevill and figured by Blanford on p. 182 (*loc. cit.*) = *celox*. The question requires some further explanation. In 1883 I published a paper in the 'Journal of the Asiatic Society of Bengal' on the drawings left with Stoliczka's collection of Mollusca in Calcutta when he was appointed Naturalist to the Yarkand Mission. Among them fig. 5, plate 5, = figure No. 49 of the drawings, represents *Nanina camura*, as identified, and correctly so I consider, by Nevill. No name, only the locality "Darjiling," had been given by Stoliczka. In spirit-specimens of this last species it is interesting to find that the extremity of the foot is truncate and the lobe above small and blunt, very different to the long pointed lobe in spirit-specimens of *Macrochlamys tugurium*, *vide* fig. 46 of Stoliczka's drawings, one of which was not included in my paper of 1883, as it had already been copied on Plate XIX. fig. 2 of 'Land and Freshwater Mollusca of India,' January 1883. The different form of the mucous glands noted above in spirit-specimens is well brought out in these two drawings, and shows, moreover, how reliable is the work of the native artist Stoliczka employed. Nevill wrote in pencil opposite No. 46, "*N.* (*Rotula mainwaringiana*)"; but I attach no value to this, for Nevill had little knowledge of the animals. These drawings of Stoliczka are natural size; the shell in the case of his figure 46 is, I note, 21 mm. in major diameter, whereas the type of *B. mainwaringi* now before me is 27 mm. and is the shell lately figured by Blanford. The shell-lobes depicted in fig. 46 conclusively show it to be a *Macrochlamys*, and there can be little doubt it represents the animal of a typical-sized *Macrochlamys tugurium*. Fig. 22 of Stoliczka's drawings bears the name *tugurium* beneath it in his own handwriting; the end of the foot is pointed, but, as I have before indicated, it is drawn in such a position that the shell-lobes would not be seen.

Fig. 21 by Stoliczka is quoted in Nevill's 'Hand-list,' 1878,

p. 49. no. 272. *Nanina* (*Bensonia*?), n. sp. The drawing had originally "*lubrica?*" written on it by Stoliczka; subsequently there was written in pencil on the opposite page by Nevill, "This is not *Macro. lubrica*? is it *mainwaringi* or an ally? It is a species of *Rotula*, vide Stol." In Nevill's amended 'Hand-list,' which he never lived to see published by the Calcutta Museum Trustees, and which he left to my care shortly before his death, I find the name "*mainwaringiana*" inserted in ink to No. 272 in place of n. sp. in the text. He had sent me also the type.

Considerable doubt exists as to whether the animal of No. 21 of Stoliczka, clearly without shell-lobes, can be associated with the shell known to Nevill as *mainwaringi* or *mainwaringiana*. Until we obtain this last shell and its animal in spirit, we cannot be certain by any means to what subgenus it may belong. All Stoliczka's pencil notes made on the margins of the drawings were carefully copied by me into the book in ink so far as they could be deciphered, some having become very indistinct. All Nevill's notes were made after the book was finally bound. In that year, 1877, Nevill was receiving consignments of shells from Colonel Mainwaring, who was up at Darjiling, and had collectors out in the neighbouring hill country.

Macrochlamys richilaensis, n. sp. (Plate CV. figs. 1–1 *g*.)

*Locality*. Richila Pass (10,370 ft.).

Shell (figs. 1, 1 *a*) subdepressedly globose, very narrowly perforate, glassy, very transparent; sculpture none, transversely crossed by regular shallow close furrows; colour greenish ochre; spire depressed: suture shallow; whorls 4, rather rapidly increasing, showing at intervals 3 varices of progressional growth; aperture subvertical, widely lunate; columellar margin subvertical, not thickened and scarcely reflected. The aperture was covered with a thick membranaceous epiphragm.

Size: maj. diam. 18·75, min. 14·75; alt. axis 8·5 mm.

The animal is dark green near the extremity of the foot. The margin as well as the sole of the foot is pale ochre in the spirit, probably ruddy ochre in life, quite a contrast to the upper part. Sole of foot divided. As regards the general form, mucous gland, and neck-lobes it is very like *M. dalingensis* (Plate XXXV.). The apical whorls of the visceral sac (Plate CV. fig. 1 *b*) are black, sparsely speckled with ochre: where the membrane covering the heart and kidney commences this colouring is reversed; the ground is pale, openly speckled over with ovate black markings and dots, with an undefined band of same colour near the mantle-zone. A loop of the intestine is defined in black.

The jaw (fig. 1 *d*) has no central projection.

The radula (figs. 1 *e*, 1 *f*, 1 *g*) is nearly the same as in *Dalingia bhutanensis*, only that the marginal teeth are much more evenly bicuspid:

24 . 2 . 18 . 1 . 18 . 2 . 24
44 . 1 . 44

The generative organs (fig. 1 *c*) present very remarkable variation from typical *Macrochlamys*, particularly in the form of the penis. The kalc-sac is very long, quite a flagellum, and close to where the retractor muscle is given off there is a long free cæcum loosely coiled; this undoubtedly represents the closely-wound cæcum in the type species, to the side of which the retractor muscle is usually attached. In this species the cæcum is quite free, the retractor muscle rising at the base of the cæcum itself. The spermatheca is also very long and abnormal in form, consisting of a capacious thin-walled sac at the extremity of a thick muscular stalk-like tube, equal in length to the sac it terminates in. The amatorial organ is thick and large, with a very strong lengthened retractor muscle.

Here comparison must be made with the generative organs of *M. sathilaensis* and *M. zemoensis*. In both species the penis presents a similar departure from that of typical *M. indica*; in both the *penis cæcum* is free and loosely coiled, merely kept together by a few muscular fibres, whereas in *M. indica* this cæcum is closely coiled into a mass impossible to unroll, and this is the dominant type over an extensive area of country.

This departure in form in the Eastern Himalayan species appears to me of considerable interest, one to which I would call the attention of those interested in the gradual modification of special organs. It shows (and it must have been a very slow process indeed) how evolution has affected morphological changes in this group of molluscs, everywhere so extremely alike in general appearance of their shells, and yet on the extreme limits of their distribution the internal organs present most remarkable divergence in some point or another.

It might very reasonably be asked whether the description of the markings and coloration of the visceral sac is worthy of record, and until lately I should myself have placed little stress upon it. However, the collection I have been at work upon contains dozens of examples in many species, and of some there are over a hundred. It soon became apparent, when a number had been sorted, how very constant, in many cases, was the pattern of the marking, and I found I could sort them out quicker by a glance at the animal than by looking at the shell. The sculpture of this last can always be referred to as another test of identification should any doubt arise. In immature shells the colour-character and markings of the animal are even safer guides, for they begin to show at a very early stage, when the shells themselves are really, in these glassy forms, most difficult to identify.

Macrochlamys damsangensis, n. sp. (Plate CV. figs. 2–2 *f*.)

*Locality*. Damsang Peak, Daling District, Bhutan Dooars. One fully-grown shell and three younger. A number from Rissom Peak; one half-grown, Rarhichu, Sikkim.

Shell (figs. 2, 2 *a*) depressedly globose, scarcely perforate, glassy; sculpture indistinct irregular longitudinal striæ, but quite smooth in places; colour rich sienna-brown, pinkish inside the aperture; spire depressed; suture shallow; whorls 4 (not quite fully grown), rather tumid and rapidly increasing; aperture subvertical, ovate, the peristome on outer margin nearly the curve of a true circle. Columellar margin weak, subvertical, scarcely reflected.

Size: maj. diam. 18·5, min. 14·7; alt. axis 6·4, alt. body-whorl 6·8 mm.

*Animal* (Plate CV. figs. 2 *b*, 2 *c*). Has the typical shell-lobes of *Macrochlamys.* The specimen dissected was much contracted and hardened by the alcohol, so that the mucous gland and lobe above both appear small. This smallness is, however, not all due to contraction. The sole of the foot is strongly divided into middle and lateral areas. The peripodial groove is conspicuous and the margin broad. The membrane covering the pulmonary cavity (fig. 2 *b*) is of a dark green colour, closely speckled, and above the renal organ and heart is quite black. The foot of the animal is concolorous both above and below, of an olivaceous tint, darker on the head and tentacles. The specimens were evidently taken in the cold season, for the generative organs were found to be exceedingly small and contracted and in trying to get them out were broken, yet sufficient was seen to show there was an amatorial organ and the general form of the penis. This shows a long kalk-sac or flagellum (fig. 2 *d*) and a convolution where the retractor muscle is given off; it therefore agrees with the typical form of this organ in this genus, although its form must be much altered and swollen during the season of reproduction.

The jaw (fig. 2 *e*) has a central projection.

The radula (fig. 2 *f*) formula is

$$25 . 1 . 18 . 1 . 18 . 1 . 25 = 44 . 1 . 44$$

The central tooth is rather narrow, long, tricuspid; the admedian teeth also on narrow plates, with one side cusp; the outer teeth are unevenly bicuspid. The breadth of the central portion is far greater than that of both the marginal parts.

This species, as regards its shell, may very easily be mistaken for *M. richilaensis* at a casual glance; it is, however, a much stronger shell and not so globose. The animals are very differently coloured, particularly in the distribution of colour; and there is great diversity in the generative organs.

Macrochlamys beata, n. sp. (Plate CVIII. figs. 1, 1 *a*, 1 *b*.)

*Locality.* Shengorh Peak, Dafla Hills, 6000 ft. (*Godwin-Austen*).

Shell depressedly globose, rather thin, imperforate; sculpture wavy, strong, regular longitudinal striation, crossed by distant lines of growth; colour olivaceous brown: spire low, apex rounded; suture shallow; whorls 5, gradually expanding; aperture ovate,

oblique; peristome thin; columellar margin oblique, with a very slight reflection.

Size: maj. diam. 12·0, alt. axis 4·5 mm.

Among specimens of this shell, I noticed one which contained a dried-up animal in good preservation. It was put to soak, and after 15 days was examined, when the external characters were remarkably well seen, even to the peripodial grooves and streaks on side of the foot. It has a narrow tongue-like right shell-lobe and a similar well-developed left shell-lobe. After further soaking in water for 24 days, the amatorial organ was well seen and the jaw secured; the radula was broken up, but after a long search over three glass slides which had been in use I found and mounted a portion of it. The central teeth have a cusp on the outer side and a small one on the inner apical margin. The admedian are all short and straight-sided, not bicuspid, an unusual character.

The shell-lobes are like those of *Macrochlamys*, and I place it in that genus. I thought at first I had re-found in the Dafla Hills Henry Blanford's Darjiling species, *Helicarion ovatum*, J. A. S. B. 1876, p. 312, of which the type appears to be lost; but on looking over his description again I see he compares *ovatum* with species of the *H.-salius* type from the shell-character. The shell of this Dafla species does not resemble *H. salius*, and the external character of the animal is quite different.

Macrochlamys razamiensis. (Plate CVIII. figs. 2, 2 *a*, 2 *b*.)

*Locality*. Kopamedza Peak, Naga Hills (*Godwin-Austen*).

Shell globose; umbilicus concealed, very thin and transparent, glassy; sculpture none; colour pale sap-green; spire subconoid; suture shallow; whorls 5, very convex and rounded on the periphery; aperture ovate, nearly vertical; peristome very thin; columellar margin oblique.

Size: maj. diam. 10·25, alt. axis 4·75 mm.

*Animal*. Shell-lobes present, but not well preserved in the soaked specimen. Foot moderately large, gland seen; olivaceous in colour; sole divided.

Animal dark-coloured, the shell-lobes still darker.

Jaw with a central projection.

Radula has a formula:

$$\frac{39 . 2 . 10 . 1 . 10 . 2 . 39}{51 . 1 . 51.}$$

Centre tooth bicuspid; admedian teeth bicuspid; laterals bicuspid, becoming rapidly minute on the margin.

Macrochlamys mahadeoensis, n. sp. (Plate CVIII. figs. 3, 3 *a*, 3 *b*.)

*Locality*. Mahadeo Peak, Burrail Range, near Asalu (*Godwin-Austen*).

Shell depressedly globose, thin, not umbilicated; sculpture

smooth, crossed by irregular lines of growth ; colour dull olivaceous green ; spire flatly conoid ; suture impressed ; whorls 4, the last expanding and capacious, rounded on the periphery ; aperture flatly ovate, subvertical ; peristome thin ; columellar margin suboblique.

Size : maj. diam. 11·5, min. 9·5 ; alt. axis 5·0 mm.

Shell-lobes, from what was left of them, resemble those of typical *Macrochlamys*, tongue-like.

Jaw not found.

Radula formula :

$$\begin{array}{c} 43 \ . \ 2 \ . \ 10 \ . \ 1 \ . \ 10 \ . \ 2 \ . \ 43 \\ 55 \ . \ 1 \ . \ 55 \end{array}$$

The centre tooth is tricuspid; the admedian teeth have a small cusp on the inner side just below the main point, with another basal cusp on the outside; the lateral teeth are evenly bicuspid, the marginals small.

In this species the odontophore is of the same type as that of *Austenia gigas*, with the inner upper cusp on the admedian teeth.

Macrochlamys hengdanensis, n. sp. (Plate CVIII. figs. 4, 4 *a*, 4 *b*.)

*Locality*. Hengdan Peak, North Cachar Hills (*Godwin-Austen*).

Shell globosely conoid, very thin, transparent, somewhat glassy, umbilicated, extremely minute and hidden ; sculpture, surface quite smooth ; colour pale sap-green ; spire subconical, apex elevated, blunt ; suture shallow ; whorls $4\frac{1}{2}$ ; aperture suboblique, nearly circular ; peristome very thin ; columellar margin subvertical.

Size : maj. diam. 10·4, alt. axis 5·0 mm.

Animal not seen.

A species very close to *M. hengdanensis* in form comes from the Munipur Hills, associated with *M. razamiensis*. I put a specimen containing the dried animal to soak, but unfortunately left it too long. On examination I obtained nothing but the jaw ; this has no central projection, proving that it is a distinct species from those I have figured, and it may possibly be an *Austenia*. I take the opportunity now it is before me of describing it, without a figure :—

Macrochlamys munipurensis, n. sp.

*Locality*. N.E. Munipur Hills (*Godwin-Austen*). Two specimens in collection.

Shell very globose and conoid, thin, scarcely and finely perforate ; sculpture smooth and glassy to the eye, yet under high power and in good light extremely fine fairly regular striation is visible ; colour pale straw with a green tinge ; spire high, conic ; suture

impressed; whorls $4\frac{1}{2}$, the last expanding rapidly, well rounded on the periphery; aperture roundly lunate, subvertical; peristome thin; columella very weak, scarcely any reflection, margin suboblique.

Size: maj. diam. 11·5, alt. axis 6·5 mm.

MACROCHLAMYS LAHUPAENSIS, n. sp.

*Locality*. Phunggam, Lahupa-Naga Hills, N.E. Munipur (*Godwin-Austen*). Eight specimens.

Shell subdepressedly conoid, rounded below, thin, perforation fine, nearly concealed; sculpture none under high power, crossed by many fine wavy lines of growth under eye; colour pale ashy ochre; spire subconic, sides flat, apex fine; suture impressed: whorls $5\frac{1}{2}$, closely wound, particularly near the apex; aperture widely horizontally lunate, subvertical; peristome both slightly thickened and sinuate; columellar margin oblique and very slightly reflected near the umbilicus.

Size: maj. diam. 13·0, min. 11·0; alt. axis 6 mm.

MACROCHLAMYS HODGSONI, Benson (Blf. MS.). (Plate CIX. figs. 1, 1 *a* (typical), 2–2 *d*.)

*Helix hodgsoni*, Benson, A. M. N. H. 1859, iii. p. 267; Pfr. Mon. Hel. vol. v. p. 151; Hanley, Conch. Ind. p. 15, pl. xxxi. figs. 2, 3.

*Macrochlamys* (sec. D), Theob. Suppl. Cat. p. 19.

*Nanina* (*Microcystis*), Nevill, Hand-list, p. 38.

*Helix hodgsoni*, Pfr. Malak. Blätt. 1859, p. 21. no. 309 *a*.

*Microcystis* (sec. B. Perforatæ, *a*. Ecarinatæ), Clessin, Nomen. Helic. p. 37.

Original description:—"*Testa anguste perforata, globoso-depressa, solidiuscula, radiato-striatula, superne striis minutissimis inconspicuis spiralibus sculpta, subtus nitidula, translucente, sub epidermide caduco, pallide corneo, albida; spira conoidea, apice obtuso, sutura impressa, leviter marginata; anfractibus 5, primis sensim crescentibus convexiusculis, ultimo ad peripheriam compresse convexo, subtus convexiusculo; apertura subobliqua, subquadrato-rotundato-lunari, peristomate tenui, recto, margine columellari subverticaliter descendente, superne reflexo, marginibus callo tenui junctis.*

"Diam. major vix 7, minor 6, axis $4\frac{1}{2}$ mill.

"Habitat at Pankabari, in regione calidiori Terai.

"A single worn specimen of this species is in the Collection. In form and many characters it so nearly tallies with a little undescribed shell which I collected at Mussoorie and Landour, that I feel much disposed to unite them; but the greater comparative solidity of the Darjiling specimen, the caducous epidermis, and the circumstance of the margins being united by a callus, of which there is no trace in any of my Western specimens, make it undesirable to confound them until a series of the Darjiling species can be had for comparison. The species was probably named by Mr. W. T. Blanford

either after the distinguished engineer, Col. J. A. Hodgson, who first explored Darjiling and wrote a paper on its topography, which was published in the 'Gleanings of Science,'—or after Mr. Brian Hodgson, formerly Resident at the Court of Nipal, and latterly residing at Darjiling, whose diligent investigation of the Mammalia and Birds of those regions is well known to naturalists."

I give drawing of a typical shell (Plate CIX. fig. 1) in Dr. W. T. Blanford's collection *: sculpture (fig. 1 *a*) finely decussate; colour pale ochraceous. It measured 6·9 mm. in major diameter.

From the Richila Peak I have a large number, some very fine, with the same distinguishing sculpture. The largest measures 8 mm. in major diameter; and these fresh specimens are all of a umber-brown colour, with a slight green tint. I found only very young specimens preserved in spirit. Right and left shell-lobes are present, the last large (figs. 2, 2 *b*). Extremity of foot with a long lobe (fig. 2 *a*). Visceral sac with 4 transverse narrow black streaks (fig. 2 *b*). Jaw (fig. 2 *d*) with a central projection; in the radula (fig. 2 *c*) the central and admedian teeth are narrow and long, one cusp on outer margin; laterals bicuspid and even. Formula:

$$\frac{50 \;.\; 2 \;.\; 7 \;.\; 1 \;.\; 7 \;.\; 2 \;.\; 50}{59 \;.\; 1 \;.\; 59} \text{ about}$$

MACROCHLAMYS RORIDA, Bs. (Plate CIX. figs. 3, 3 *a*, 3 *b*.)

*Helix rorida*, Benson, Ann. & Mag. N. H. 1859, iii. p. 266; Pfr. Mon. Hel. vol. v. p. 111 (1868); id. Malak. Blätt. 1859, p. 21.

*Microcystis* (sec. B. Perforatæ, *a*. Ecarinatæ) *rorida*, Clessin, Nomen. Helic. (1881).

*Macrochlamys* (sec. D) *rorida*, Theob. Suppl. Cat. p. 19 (1876).

*Nanina* (*Microcystis*) *rorida*, Nevill, Hand-list, no. 166, p. 38.

*Locality*. Darjiling (*W. T. Blanford*: No. 33 of his collection).

Shell (fig. 3, typical specimen): sculpture smooth to the eye, but with regular spiral furrowing under high power; colour olivaceous green.

Specimen figured: major diam. 5·5, alt. axis 3·2 mm.

Original description:—"*Testa subperforata, globoso-depressa, tenuissima, minutissime radiato-striatula, polita, pellucida, fusco-cornea; spira depresse conoidea, apice obtuso, sutura impressiuscula, tenuimarginata; anfractibus 4, convexiusculis, ultimo ad peripheriam convexo, subtus convexiusculo; apertura obliqua, subrotundato-lunari, peristomate tenui, recto, margine columellari verticali, arcuato, superne brevissime reflexo, perforationem fere celante.*

"Diam. major 5, minor $4\frac{1}{2}$, axis $2\frac{1}{2}$ mill.

"Habitat at Darjiling, necnon ad collem Sunhul [Senchal Peak], 8600 feet.

"Independently of its smaller size, translucent dark corneous tinge and polish, this shell is distinguished from *H. hodgsoni*,

* Yellow label; No. 32. Now in the National Collection.

Blanford, by the narrow but more distinct margination of the suture, its more depressed spire, fewer whorls, and by the absence of any degree of compression at the periphery. It inhabits a region varying from 7000 to 8000 feet, living, according to Mr. W. T. Blanford, on succulent shrubs."

From specimen preserved by Dr. W. T. Blanford:—Animal dark-coloured above; sole of foot and the outer peripodial margin pale in contrast; between the peripodial grooves dark-coloured, as well as the segmental divisions above. Horn above mucous pore well developed. The left shell-lobe and right shell-lobe both long and tongue-like; the left dorsal lobe rather small and narrow.

A fine specimen from Rissom Peak, W. Bhutan, measures in major diameter 8 mm. and is dark green in colour.

MACROCHLAMYS FRAGOSUS, n. sp. (Plate CIX. fig. 4.)

*Locality.* Torúpútú Peak, Dafla Hills (*G.-A.*).

Shell scarcely perforate, globose, thin, translucent; sculpture fine microscopical regular longitudinal striæ; colour sap-green; spire flatly convex; suture shallow; whorls $3\frac{1}{2}$, last swollen and rounded at the periphery; aperture semi-ovate; columellar margin perpendicular, not reflected, weak.

Size: maj. diam. 6·7, min. 6·0; alt. axis 3·5, alt. body-whorl 2·8 mm.

Since this shell was figured by me it has been considerably damaged, but fortunately two other specimens should be preserved in the Calcutta Museum. The specimen described above was sent to me by Geoffrey Nevill as 167 B of his 'Hand-list,' p. 39, under

"*Nanina* (*Microcystis*), n. sp.

"3 Torúpútú; coll. Major H. H. Godwin-Austen.

"5 Sikkim; coll. Dr. F. Stolicka."

Specimens from both localities came with the MS. name of *perfragilis*, the Sikkim species being marked 167 A *type*. They are not, however, identical (compare figs. 4 & 5 on Plate CIX.).

No example of 167 B, *M. fragosus*, occurs in my collection in this country, which is thus explained:—After the punitive expedition against the Dafla Tribe in 1874/75, I placed all the shells I had collected in that part of the Eastern Himalayas in the hands of my friend Nevill, to select what he wanted for the Museum and to work them out, which he only lived to partially do. Fortunately he sent home some of the duplicates for me to figure and describe in this work, and I have thus been able to clear up many of the species recorded as new that are to be found in the 'Hand-list.'

MACROCHLAMYS ? PERFRAGILIS, Nevill, MS. (Plate CIX. fig. 5.)

*Locality.* Sikkim (*Dr. F. Stoliczka*).

Shell globose, scarcely perforate, thin membranaceous character; sculpture very minute, fine regular longitudinal striæ; colour sap-green; spire low, apex rounded and blunt; suture very shallow;

whorls $4\frac{1}{2}$, rounded on side, flat above; aperture broadly lunate, vertical; peristome very thin; columellar margin scarcely thickened, subvertical.

Size: maj. diam. 7·0, min. 6·0; alt. axis 3·8 mm.

This shell was sent as 167 A, as the type of *perfragilis*. There should be four specimens left in the Calcutta Museum: see my remarks under the preceding species.

MACROCHLAMYS SUPERFLUA, W. T. Blanford.

*Macrochlamys superflua*, P. Z. S. 1904, ii. p. 442, pl. xxv. fig. 7.

*Habitat*. The Teesta Valley, Sikkim.

The figure given on Plate CIX. was made from a specimen sent to me by Nevill many years ago; with a much larger series to deal with, it proves to be the young shell of a form about the size of *M. lubrica*, to which Dr. W. T. Blanford has since given the above name.

The description of this very young shell (Plate CIX. fig. 6) is as follows:—

*Locality*. Darjiling (*coll. Colonel Mainwaring*).

Shell subglobosely conoid, narrowly umbilicated, shiny, thin; sculpture wavy, rather broad longitudinal bands, visible under low powers; colour pale sienna-brown; spire depressedly conoid; suture shallow, adpressed; whorls $4\frac{1}{2}$, the last rather tumid and rapidly increasing; aperture broadly lunate, oblique; peristome very thin, scarcely reflected on columellar margin.

Size: maj. diam. 5·6, alt. axis 2·3 mm.

On comparison of large scale drawings made with camera lucida it is seen at once that the coil of *superflua* is closer and more regular than that of *M. sequius*.

MACROCHLAMYS SPRETA, W. T. Blanford. (Plate CIX. figs. 8, 8*a*.)

*Macrochlamys spreta*, P. Z. S. 1904, ii. p. 445, pl. xxv. fig. 12.

Original description:—"*Testa minute et subobtecte perforata, depressa, tenuis, nitida, polita, lineis impressis spiralibus sub lente undique ornata, pallide castanea, subtus circa perforationem albescens; spira parum elevata, conoidalis, sutura vix impressa; anfr. 5, convexi, ultimus majusculus, ad peripheriam rotundatus, subtus convexus; apertura obliqua, subovato-lunaris; peristoma tenue, rectum, margine columellari obliquo, leviter reflexo.*

"Diam. maj. 8, min. 7, alt. 3·5 mm.

"*Hab.* ad Thamandewa in pago Bassein et in aliis partibus provinciæ Pegu Burmannicæ (*W. T. B.*).

"Near *M. subpetasus*, Nevill, and *M. noxia*, but easily recognised by the spiral striation."

This shell was figured from a specimen in Dr. Blanford's collection named *causia*; it was not, however, that species. In the last paper written by Blanford (1904) it is described with some other Burmese shells, which had remained unnamed for many years.

The sculpture shows longitudinal regular distant rather wavy striæ, coarser near the suture and very distinct on the basal side. Maj. diam. 7·5, min. 6·7; alt. axis 3·0 mm.

MACROCHLAMYS SALWINENSIS, n. sp. (Plate CIX. fig. 9.)

*Locality.* Salwin Valley.

Shell globosely conoid, scarcely perforate, quite smooth; colour ochraceous; spire moderately high, apex rounded: whorls 5, regularly increasing, somewhat convex; aperture oblique, semi-ovate; columellar margin vertical; peristome slightly reflected.

Size: maj. diam. 6·7, min. 5·8; alt. axis 3·5, body-whorl 2·8 mm.

This shell was sent me by Mr. Nevill as No. 142, p. 36, of his 'Hand-list,' *Nanina* (*Microcystis*) *causia*, Bs., from the Salwin. It agrees very well with the figure in the Conch. Indica (pl. xc. figs. 2, 3), which was possibly a typical specimen, as it is recorded on p. 37 as from Phiethan, Tenasserim, and should now be found in the McAndrew Collection at Cambridge, among Benson's shells.

The shell (fig. 9) from the Calcutta Museum does not altogether agree with Benson's description of *H. causia*, which I give below for comparison, particularly in the sculpture.

MACROCHLAMYS CAUSIA, Benson.

*Helix causia*, Bs. A. M. N. H. 1859, vol. iii. p. 388; Pfr. Mon. Hel. vol. v. p. 118; Hanley, Conch. Ind. pl. xc. figs. 2, 3.

*Macrochlamys* (sec. D) *causia*, Theob. Suppl. Cat. p. 19.

*Nanina* (*Microcystis*) *causia*, Nevill, Hand-list, p. 36. no. 142.

*Trochomorpha* (sec. i. *Nigritella*) sp., Pfr. ed. Clessin, Nomencl. Helic. p. 81 (1881).

Original description :—" *Testa perforata, conoideo-depressa, solidula, oblique striatula, striis minutissimis confertissimis spiralibus sub lente signata, nitidula, fulvescenti-cornea, subtus pallidori; spira conoidea, sutura impressa, submarginata, apice obtuso, hyalino; anfractibus* 5, *convexiusculis, ultimo ad peripheriam valde rotundato: apertura obliqua, subrotundato-lunari, peristomate acuto, recto, margine columellari breviter expanso-reflexo.*

" Diam. major 7, minor 6, axis 4 mill.

" Habitat ad Phie Thán, vallis Tenasserim.

" A small *Nanina*-like species, with no very prominent character besides the minute spiral sculpture."

MACROCHLAMYS HOOKERI, n. sp. (Plate CIX. figs. 10, 10 *a*.)

*Locality.* Cherra Poonjee and in the valley to the eastward.

Shell scarcely perforate, tumidly globose, thin, diaphanous, smooth, strong epidermis; colour dull ochraceous; spire depressedly conoid; whorls 4, slightly convex above, rather rapidly increasing; aperture

suboblique, ovoid; peristome nearly circular on the periphery; columellar margin straight, perpendicular, weak.

Size: maj. diam. 10·0, min. 8·2; alt. axis 4·0 mm.

This shell was also found at Jawai, in the Jaintia Hills. I have named it after Sir Joseph Hooker, who describes so well in his 'Himalayan Journals' the deep valley under Cherra Poonjee.

Macrochlamys zemoensis, n. sp. (Plate CX. figs. 1–1 *h*.)

*Locality.* Zemo Samdong, Sikkim, valley of the Lachen, about 12,000 feet. In the pine-forests.

Shell (figs. 1, 1 *a*) globosely conoid, glassy, fragile, narrowly umbilicated; sculpture quite smooth; whorls transversely crossed by wavy furrows of growth, here and there traces of longitudinal striæ under high power; colour ochraceous with an olive tint, some more sienna-brown than others; spire rather depressed, apex rounded; suture moderately impressed. Whorls 5, regularly increasing; aperture broadly lunate; peristome very thin; columellar margin weak, scarcely reflected.

Size: maj. diam. 10·0, min. 9·0; alt. axis 4·5 mm.

Animal (figs. 1 *b–d*) with a dark-coloured broad margin to the foot, pale on the keel of same, the pallial fringe broad; the lobe over the mucous gland long and pointed; sole of foot well divided. The right shell-lobe (fig. 1 *c*) is large, rather broad at base. There is a small narrow left shell-lobe and the left dorsal lobe is in two separate parts. The visceral sac (fig. 1 *b*) is sparsely spotted near the suture, with a black band bordering the mantle-zone, and a long black band runs parallel to the renal organ. The salivary glands (fig. 1 *e*) are in one compact mass.

*Genitalia* (fig. 1 *f*). The penis-muscle is attached to a coiled free cæcum, as I have noticed in *M. richilaensis*; there is a short flagellum where the vas deferens joins. The amatorial organ is moderately long and straight.

The jaw (fig. 1 *g*) has a central projection.

The radula formula is

$$\frac{35 \;.\; 1 \;.\; 9 \;.\; 1 \;.\; 9 \;.\; 1 \;.\; 35 \text{ to } 40}{45 \;.\; 1 \;.\; 45}$$

The centre tooth is tricuspid; the admedian teeth have a very small inner cusp high up on inside and a larger one lower down on the outside: the marginal teeth are bicuspid, the outer cusp below the main one (fig. 1 *h*).

Macrochlamys rakaensis, n. sp. (Plate CX. figs. 2–2 *b*.)

*Locality.* Richila Peak, Bhutan frontier.

Shell (fig. 2) subdepressedly globose, very narrowly perforate; sculpture well marked, fine, regular, longitudinal striation, showing even on the lower side; it is a far stronger striation than is seen in *M. sathilaensis*; colour pale ashy brown; spire flatly conoid; suture

impressed. Whorls 5, not fully grown; aperture widely lunate, subvertical; peristome very thin; columellar margin subvertical, with slight reflection.

Size: maj. diam. 9·0, alt. axis $3\frac{1}{2}$ mm.

The coil of the spire differs from that of *M. sathilaensis.*

*Animal.* Pale-coloured throughout, with black head and the extremity of the foot tinged very slightly darker towards the tip of the overhanging lobe. Both the shell-lobes are very long, particularly the right, longer than in any spirit-specimen I have ever handled. The right dorsal lobe is small, the left in two parts. The lobe over the mucous gland is not very pointed. The visceral sac is umber-brown, sparsely mottled in frout with black, and a long black streak next the renal organ.

*Generative organs.* The coiled cæcum is exactly like that of the typical species. The kalc-sac is long. The spermatheca long. The radula is like allied species in every way (only the central tooth and admedians seen):—

+ . 2 . 10 . 1 . 10 . 2 . +

MACROCHLAMYS EXUL, Theobald. (Plate CXI. figs. 2–2 *d.*)

*Macrochlamys exul*, Land & Freshw. Moll. Ind. pt. iv. p. 103, pl. xxii. fig. 3 (shell); Pfr. Mon. Hel. vii. p. 108.

*Locality.* Mount Harriet, South Andaman Island (*A. Meyer*).

The shell of this species was described and figured, Vol. I. p. 103, Plate XXII. fig. 3.

The animal had not then been seen, and considerable doubt existed as to its position in the genus *Macrochlamys.* Thanks to Dr. A. Meyer, who generously sent me a number of land-shells preserved in spirit, collected on his Eastern tour, I am now able to show that it does fall into that genus. A certain amount of variation is shown in minor details of the generative organs, which on comparison with the figures of Bengal species is shown better than by description; while allowance must always be made for the period of life and the active or passive state of these organs when the specimen is taken.

*Animal.* Ochraceous in spirit. Foot divided on the sole, extremity rounded; mucous gland large, with a blunt overhanging lobe. Right and left shell-lobes (figs. 2, 2 *a*) are present, the latter apparently larger than usual in the genus. In the generative organs (fig. 2 *b*) the penis has a coiled cæcum; a long retractor muscle given off from it. The epiphallus thence to the junction of the vas deferens is very long, and at the junction gives off a long kalk-sac. The amatorial organ is long. The spermatheca cousists of an oval sac at the end of a thickened stem.

Jaw (fig. 2 *c*) moderately curved, with a slight median projection.

Radula (fig. 2 *d*) formula:

35 . 1 . 10 . 1 . 10 . 1 . 35

or 46 . 1 . 46

Central tooth rather short, with small blunt basal cusps; the admedian teeth on quadrate plates, blunt cusps low down on outer margin; the laterals are long, aculeate, and slightly curved, becoming very short on the outer margin.

This radula is very different from that of typical *Macrochlamys*, and so is the genitalia, and if it should be common to all the Andaman species, it would constitute them a good subsection.

Aculeate laterals have been noticed in the following species:—*M. jainiana*; *M. castaneolabiata*; in *M. tugurium* the outermost teeth; and in *M. dalingensis* they are nearly aculeate.

Macrochlamys sequax, Bs. (Plate CVI. figs. 1–1 *d*; *sequax* ?, figs. 3–3 *a*.)

*Macrochlamys sequax*, Bs. A. M. N. H. 1859, iii. p. 270; Pfr. Mon. Hel. vol. v. p. 118; Hanley, Conch. Ind. p. 28, pl. lxiii. figs. 1, 2, 3.

*Macrochlamys* (sec. A) *sequax*, Theob. Suppl. Cat. p. 18.

*Nanina* (*Macrochlamys*) *sequax*, Nevill, Hand-list, p. 23.

*Helix sequax*, Pfr. Malak. Blätt. 1859, p. 23. no. 346 *a*.

*Macrochlamys* (sec. A. Ecarinatæ) *sequax*, Clessin, Nomen. Helic. p. 44.

Original description:—"*Testa perforata, subconoideo-depressa, fere tenui, oblique striatula, sub lente confertissime spiraliter obsolete striata, nitida, diaphana, livide olivaceo-cornea; spira depresso-conoidea, lateribus convexiusculis, apice obtuso, sutura impressa, subcanaliculato-marginata; anfractibus $5\frac{1}{2}$, convexiusculis, sensim accrescentibus, ultimo antice (ætate) vix descendente, ad peripheriam compresse rotundato, subtus convexiusculo, medio excavato; apertura obliqua, transversim lunata, peristomate tenui, recto, margine basali arcuato, columellari breviter reflexo.*

"Diam. major 18, minor 15, axis 7 mill.

"Habitat copiose ad Darjiling et in valle Rungun [Rungnu] (7000 et 4000 ped. alt.).

"Several years ago, a series of specimens was sent to me by Mr. Robert Trotter, with other fine species procured by him at Darjiling, and described in former Numbers of the 'Annals.' The shell rarely attains the extreme size noted; and, from its fragility, the lip is seldem perfect. A livid greenish olivaceous tint is observable in most specimens, which, with the slight concavity of the sides of the spire, serves to distinguish the species at the first glance from others of the type of *Nanina vitrinoides*, Desh. Mr. W. T. Blanford found it at elevations varying from 4000 to 7000 feet, and states that it is also met with at the foot of the Khasia Hills; but I cannot find a specimen among the immature Naninoid shells received from that quarter through Mr. Theobald, which can be with certainty assigned to this form."

The material used in the following descriptions was derived from several sources: the most reliable as regards this species from Dr. W. T. Blanford, collected by him at Darjiling and preserved in spirit; also the shells in his collection (Plate CVI. fig. 1). When in Calcutta in 1877, Mr. G. Nevill placed in my hands a shell identified by him as *M. sequax*, which he had just received alive from Darjiling, sent by Colonel Mainwaring. I made a careful description of the animal at the time in my note-book, which I give below; but unfortunately, to make it complete, I did not retain the shell. At the same time I made a drawing, showing the form and position of the right shell-lobe (fig. 3) and of the extremity of the foot (fig. 3 *b*). In Nevill's 'Hand-list,' p. 23, there is a note on the animal by Blanford: "A true *Macrochlamys*; animal pale, with back and tentacles black.—W. T. B." Next I had from Damsang, east of the Teesta River, some shells very similar in general appearance, but smaller than the type shell, which I at first took to be *sequax*; but on closer examination these differ in several particulars sufficiently to constitute a new species.

Description of the living animal received from Darjiling:—

Living animal of *sequax*? pale ochraceous throughout, including the mantle; a greenish tint on the neck, pinkish towards extremity of foot. Tentacles dark, from the base of which run two parallel dark lines towards the aperture. From the base of the lower tentacle a groove runs diagonally up towards the posterior of the neck. Mantle slightly reflected over the peristome all round and to a greater extent on the lower margin, where on the left side, at about 0·35 inch or 9 mm. from the umbilicus, a small tongue-like process (the left shell-lobe) is given off laterally. Close to the upper angle of the aperture a well-developed right shell-lobe (figs. 3, 3 *a*) is given off *horizontally* and is often extended for ·2 inch or 5 mm., *but never above the periphery of the shell.* The posterior part of the foot (in this example) was ornamented *with four diagonal lines*, which meet above in an angle; the general surface rugose; the peripodial margin broad and defined. The mucous gland (fig. 3 *b*) overhung by a curved lobe. Length: head to shell 0·6 inch, extremity of foot to shell 0·75: total nearly 2 inches. Eye-tentacles long and slender, 0·4 inch.

The following notes were made when dissecting Dr. Blanford's specimen:—Shell (fig. 1): sculpture smooth, with indistinct fine spiral striation. Animal unicolor in spirit; peripodial margin broad. The right shell-lobe is a well-developed tongue-like process; the left shell-lobe small. The horn above the mucous gland of moderate size, blunt. Generative organs: penis (fig. 1 *a*) rather long, with a long kalk-sac. The retractor muscle is short and thick, given off from quite a large coiled cæcum. The spermatheca is very long. The amatorial organ also very long. The radula (figs. 1 *c*, 1 *d*) was extracted nearly complete; formula:

$$\frac{33 \,.\, 2 \,.\, 12 \,.\, 1 \,.\, 12 \,.\, 2 \,.\, 33}{47 \,.\, 1 \,.\, 47}$$

The admedian teeth have a single cusp on the outer side, the marginals are unevenly bicuspid, and those on the outside become very minute.

The jaw (fig. 1 *b*) has a small central projection.

MACROCHLAMYS SEQUIUS, n. sp. (Plate CVI. figs. 2–2 *g*.)

*Locality.* Damsang, Daling Hills, W. Bhutan.

Shell (fig. 2) differs in its characters from that of *M. sequax*; it is slightly more solid, globose, with more rounded apex, the major axis of the aperture directed obliquely downward, instead of horizontally as in *M. sequax*. The sculpture of these Damsang shells is rather coarse, somewhat wavy, longitudinal striation. Colour pale umber-brown. The shell of the specimen dissected had 4 whorls and was 11 mm. in major diameter, and therefore not fully grown.

The largest specimen measures: major diam. 12·25, alt. axis 5·75 mm.

Animal in spirits (fig. 2 *a*) with pale foot, black head and tentacles, and a slightly darker tint near the extremity of the foot. The right shell-lobe (fig. 2 *b*) is rather short and broad; the left shell-lobe (fig. 2 *c*) small; the left dorsal lobe is in two parts, one on each side of the left shell-lobe (fig. 2 *a*).

In the generative organs (fig. 2 *d*) there is not much difference to be found when they are compared with those of *M. sequax* (fig. 1 *a*). The kalk-sac was well developed and shows a spermatophore within it (fig. 2 *e*). The teeth of the radula (fig. 2 *g*) are of the same form, the formula differing slightly:

$$+ \ 20 \ . \ 2 \ . \ 10 \ . \ 1 \ . \ 10 \ . \ 2 \ . \ 20 \ +$$

The jaw (fig. 2 *f*) has a nearly straight edge with a slight central projection, and differs from *sequax* from Darjiling (*vide* fig. 1 *b*).

MACROCHLAMYS SEQUIUS, G. A., very young. (Plate CIX. fig. 7.)

*Locality.* Darjiling, ex Coll. Calcutta Museum.

Shell depressedly conoid, umbilicated, glassy, rather solid; sculpture fine, but distinct and regular longitudinal striæ; colour pale sienna-brown; spire flatly conoid; suture shallow; whorls nearly 4, the last well rounded; aperture ovately lunate, subvertical; peristome slightly thickened, columellar margin very slightly reflected.

Size: major diam. 5·0, alt. axis 1·9 mm.

The very young shells of *M. sequius*, as well as *superflua*, W. Blf., were sent to me by G. Nevill many years before the adult shells had been described. To better recognize small forms, I made a good many drawings, as being the only way of seeing how the species varied in this very difficult group of shells. I have found it useful to draw, with the aid of camera lucida, the protoconch and two or

three whorls, enlarged about 20 diameters. This gives the coil its size exactly, and tracings can be placed one upon the other for comparison.

Macrochlamys sathilaensis, n. sp. (Plate CVI. figs. 4–4 *c*.)

*Locality.* Richila Peak, Bhutan frontier, 7 specimens (*Wm. Robert*).

Shell (fig. 4) globosely conoid, translucent, delicate structure, narrowly umbilicated; sculpture confined to some very delicate fine longitudinal striation near the suture, which dies out, and the rest is perfectly smooth, crossed transversely by wavy furrows; colour pale ochraceous; spire moderately high, conoid; suture moderately deep; whorls 6, gradually increasing; aperture widely lunate, oblique; peristome very seldom quite perfect.

Size: maj. diam. 13·5, min. 12·0; alt. axis 6·5 mm.

This shell, which has very much the coloration of *M. sequax*, differs altogether in form. It belongs to a group very similar one to the other, very common, and very variable with locality. I cannot exactly match it with any Khasi Hill species.

*Animal.* Colour throughout pale; no markings, only a slight grey tinge near the head. The withdrawn tentacles are very black, and in life probably show as dark lines on the neck; pallial margin finely streaked. The shell-lobes and extremity of foot as in *M. sequius* from Damsang; and the radula is of the same type exactly:

$$+ \ 31 \ . \ 2 \ . \ 11 \ . \ 1 \ . \ 11 \ . \ 2 \ . \ 31 \ +$$
$$+ \ 44 \ . \ 1 \ . \ 44 \ +$$

The smaller teeth near the margin would add another 10 or 15 to the above, or about 90 in the row.

The jaw (fig. 4 *c*) is well arched, with a large central projection.

The visceral sac is closely mottled and shows dark inside the shell.

The penis (figs. 4 *a*, 4 *b*) is quite different from that of *sequax* (fig. 1 *a*); the cæcum, instead of being closely coiled, is free, similar in size and length to the kalk-sac; the epiphallus is very short, and just below the retractor muscle there is a globose enlargement of the penis-tube. The amatorial organ is long. In the free cæcum the male organ may be compared to the similar character found in *M. richilaensis*.

This species was also obtained in the Risett chu Valley, and is represented by eight specimens, some of which are rather flatter in the spire than the type. Three specimens are from Rissom Peak.

Perhaps the most interesting point brought to light by the examination of the Sikkim land-shells is the presence in three of them, viz. *M. richilaensis* *, *M. zemoensis*, and *M. sathilaensis*, of a

* For details, *vide* p. 155.

free cæcum close to the retractor-muscle attachment of the male organ, which undoubtedly represents the close coil of the type species of the genus *Macrochlamys*, more or less solid in other species. It shows so well the origin of this coil, and further that the above three species are the older in the line of development. Following on this, it points to this area of the Eastern Himalaya being the centre of dispersal of the genus. The geological evidence tends to show it is an ancient land-area from Sikkim eastward up to the margin of the present plains, an area probably coeval with that of Peninsular India, and once connected with it across what is now the delta of the Ganges.

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I have hitherto in this work, following Nevill, retained *Austenia* as a subgenus of the Helicarioninæ. I now consider it should take its place as a genus of the subfamily Macrochlamyinæ, together with *Girasia* and *Cryptosoma*. *Ibycus*, as I shall show, belongs to the subfamily Durgellinæ.

## Genus Austenia.

(*Continued from* Vol. II. p. 109.)

Austenia silcharensis, n. sp. (Plate CVII. figs. 1–3 *a*.)

*Locality*. Near Silchar, Cachar (*F. Ede*).

*Shell* (figs. 1, 1 *a*, 1 *b*). The description of *A. bensoni* will apply generally. It is bright and shining, of a straw-colour. Three whorls, these are flatter above than in that species, making the aperture wider horizontally to the axis; viewed from above, the last whorl spreads and widens outwards as it nears the aperture.

Size: maj. diam. 0·95, alt. axis 0·35.

*Animal* (figs. 2, 2 *a*). Preserved in spirit is pale vinous, greyer on the shell-lobes; on the side of the foot, just above the peripodial groove, are a series of isolated dark blotches. The foot is long behind, narrow compressed at the sides, and terminating in a long hooked point overhanging the narrow slit of the mucous gland. The sole is very distinctly divided. The peripodial groove and margin not so distinctly marked as in some species. The right and left shell-lobes are remarkably developed, particularly the former; broad and expanding, in life evidently covering the whole shell, they have a beautiful papillate surface. The length of this specimen (contracted) is 2·25 mm.

*Genitalia* (figs. 3, 3 *a*). The amatorial organ is long and cylindrical, tapering gradually to the retractor muscle. The penis is bent sharply where the long retractor muscle is given off, then there is a short swollen part where the spermatophore would be formed, and

this narrows to the vas deferens. The spermatheca is moderately long.

The jaw has a central projection.

The radula has the formula

52 . 2 . 10 . 1 . 10 . 2 . 52

or 64 . 1 . 64

Similar to that of *A. bensoni*, and the teeth are of the same tricuspid type as I have shown in Plate XXXVIII. fig. 2 (Vol. I.).

My best thanks are due to Mr. F. Ede, of Silchar, for sending me this species, of which I am glad to get the single specimen in a good state of preservation, the radula of *A. bensoni* and *sylhetensis* (*vide* Plate XXXVIII. figs. 2 and 3 *c*) having been obtained from animals that were found dried up inside their shells. This species from Silchar is very closely allied to both the above, but is distinguished by the long hooked lobe over the mucous pore, which in life must be even more extended or hooked than it is in the spirit. In this respect only it resembles *A. globosa*, which I got in the Dafla Hills (Plate XXXVII. figs. 5, 5 *a*, 5 *b*). I have now been able to examine the generative organs of this group of small shells; they are certainly extremely small when compared with *A. gigas*, Bs., the type of the genus into which they have been placed, and their shells differ much from the type, being more helicoid in form. Making due allowance for size in the generative organs, there is not much divergence to be seen, particularly in the penis, the position of the retractor muscle is the same, in fact the only difference to be found is the absence of the kalc-sac where the vas deferens unites with the penis. In *Austenia gigas* it is not large nor long—in this small animal there is scarcely room for it, the whole organ being only 0·2 mm. in length, while that of *A. gigas* is 4·0, or 20 times larger.

I consider that for the present we can safely leave *bensoni* and its allies in the genus *Austenia*.

Austenia zemoensis, n. sp. (Plate CVII. figs. 4–9.)

*Locality*. Zemo Samdong, Sikkim (*W. Robert*).

Shell (figs. 4, 4 *a*) rather depressedly globose, thin and membranous; sculpture none, a smooth shiny epidermis; colour ochraceous with a green tinge; spire low, rounded, apex just raised above the next whorl; whorls 3, gradually increasing, the last rounded and tumid; aperture and peristome not seen (broken below).

Only one specimen, placed in B.M. Collection, from which the animal (figs. 5 & 5 *a*) was drawn.

Its form is very similar to a species from Darjiling in Dr. W. T. Blanford's collection, figured on Plate XXXVII. figs. 2, 2 *a*, Vol. I.

p. 152, as *Austenia? salia*, Bs., var., a smaller or more solid shell.

Size: major diam. 11·3, alt. axis 6 mm.

The shell is of the type of *A. planospira*, but may be distinguished at once by the coil of the whorls, there being more of them. The shell is so thin and delicate, that I found it impossible to detach it from the animals preserved in spirit.

*Animal* (figs. 5, 5 *a*). Of similar form to *A. planospira*; the principal difference is noticeable in the shell-lobes, which in this species are quite smooth, whereas in *planospira* they are strongly papillate. The left shell-lobe shows a scalloped edge, with furrows running inwards towards the edge of the mantle. The left dorsal lobe is distinctly in two parts. The sides of the foot and mantle-lobes are mottled, but not strongly, and one specimen shows this only slightly on the shell-lobes. The sole of the foot is divided, but the segmental lines on the side do not extend across the central portion as in *A. gigas* and other species. The fringe of the foot is paler than the rest of the animal, from the peripodial groove to the edge of the foot.

The generative organs (fig. 9) are interesting, because in the penis there is a solid coiled rounded mass at the main bend, from which the retractor muscle is given off, and in this respect this species shows an approach to *Macrochlamys*; yet again in this connection there is also a well-developed kalc-sac or flagellum at the point of junction of the vas deferens *. The amatorial organ is short and blunt at the outer end; in this respect it is like that seen in the genitalia of *Austenia planospira*. The spermatheca is apparently long, only a part, perhaps half, is left, a portion having been broken off in dissection.

The jaw was arched, solid, and with a strong central projection.

The radula has the formula

$$\begin{array}{c} 25\ .\ 16\ .\ 1\ .\ 16\ .\ 25 \\ 41\ .\ 1\ .\ 41 \end{array}$$

The teeth are similar in form to those of *A. bensoni* of Calcutta, the outer cusp lying low down, up to the extreme marginals.

Austenia durrangensis, n. sp. (Plate CVIII. figs. 5, 5 *a*, 5 *b*; Plate CXI. figs. 7–7 *c*.)

Durrang District, Assam.

Shell depressedly globose, not umbilicated; sculpture none, surface glassy, crossed transversely by fine lines of growth; colour straw-colour; spire very low, rounded; suture shallow; whorls 2½, expansive; aperture very oval, oblique; peristome thin, narrowly edged with white; columellar margin nearly vertical.

* Compare this male organ with that of *A. planospira*, Bs. (Plate XXXVIII. fig. 1), in which it will be seen that the organ is of simpler form, there is no coil and no kalc-sac, and in this respect it assimilates to the penis of *A. gigas*, the type of the genus. Compare also with fig. 3 *a*, Plate CVII.

Size: major diam. 10·5, alt. axis 3·8 mm.

*Animal* (from a soaked specimen). Colour olivaceous with mottlings on the foot; the membrane of the branchial cavity has a margin of black on the side of the elongate kidney and the visceral sac is darkly mottled. The mucous gland linear, extremity of foot square. Shell-lobes black, the right shell-lobe (fig. 7) broad and spreading along the side of the body-whorl; the left shell-lobe (fig. 7 *a*) also a broad lappet and elongately triangular in shape. The male organ resembles that of *A. gigas*, and the amatorial organ is larger.

Jaw (fig. 7 *b*) with a very small central projection.

Radula (fig. 7 *c*) has the formula

$$\frac{70 \,.\, 2 \,.\, 15 \,.\, 1 \,.\, 15 \,.\, 2 \,.\, 70}{87 \,.\, 1 \,.\, 87}$$

The central tooth and the admedian teeth are of the usual form: the central tooth as drawn is malformed or broken, it is only the remnant of the usual tricuspid form; the laterals are evenly bicuspid.

The genus *Austenia* contains a very large number of species, which differ in many ways from the type species and *inter se*; yet I continue in this work to use this generic name in its widest sense, because the differences lie sometimes in the shell, without any corresponding change in the internal organs, and *vice versa*. Subgeneric groups will, sooner or later, have to be decided on; but until the anatomy of many more species is known, I think it premature to do so.

Mr. Cockerell has, I note, removed two species from *Austenia*, viz. *scutella* and *planospira*, and created two new genera on apparently external characters. This is indicated first in his 'Notes on Slugs,' 1891, in the 'Check-list of Slugs,' 1893, and published in 'The Nautilus,' vol. xii. May 1898, p. 10. The genera are *Euaustenia* and *Cryptaustenia*, but without description. With these also was founded another subgenus of *Ibycus*, viz. *Cryptibycus*, type *I. magnificus*, Nevill & G.-A., which I will refer to under that genus.

When the characters on which these genera were founded are not specified, little help is rendered towards a natural system of classification; in fact, it becomes more difficult than ever to locate in the new genera many species of which the animals are as yet unknown. We will take, for instance, *Cryptaustenia planospira*, with all its characters, internal as well as external. The only other species which I can at present place with it is *Austenia silcharensis*, the male organ in both being of similar type—the radula also; but *Austenia zemoensis* cannot be included in *Cryptaustenia*, because the genitalia are quite different (*vide* Plate CVII.).

In Vol. II. part ix. p. 93, under *Austenia planospira*, I pointed out that the generative organs differed from those of *Austenia gigas*, and on the other hand were like those of *Eurychlamys*, and suggested

placing it in that genus (p. 109). This last genus will receive the Southern Indian species; Mr. Cockerell's the Himalayan.

As to *Euaustenia*, type *scutella*, Bs., until *Austenia* (?) *monticola*, Bs., has been obtained and thoroughly examined and compared with it, as well as some other West-Himalayan species, no one can tell what should be included in it.

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## Genus Kaliella.

(*Continued from* Vol. I. p. 146.)

(Plate CIII. figs. 2-12.)

Kaliella nagaensis, G.-A. (Part I. p. 9, Plate II. fig. 11), was also found by me in the Dikrang Valley, Dafla Hills, and also on the Barowli River north of Tezpur.

Two specimens from Hengdan Peak, 6842 feet, lat. 25° 16′ N., long. 93° 31′ E., alluded to on p. 10, Vol. I., on re-examination appears to belong to *K. jaintiaca*, G.-A., var., described on p. 7.

I figure this species (Plate CIII. fig. 8) from one of these specimens together with its sculpture (fig. 8 *a*), which shows also how it differs in this respect from *nagaensis* (fig. 11).

Kaliella rissomensis, n. sp. (Plate CIII. fig. 9.)

*Locality*. Rissom Peak, Richila Peak, and Damsang Peak, Daling District.

This shell is like *K. sivalensis* in general form, but placed alongside of it under the microscope difference is apparent in proportion of diameter to height of spire and form of columellar margin. The sculpture is also coarser.

Size: maj. diam. 3·5, alt. axis 2·6 mm.

Kaliella jaintiaca, G.-A., var. (Plate CIII. figs. 8, 8 *a*.)

*Locality*. Hengdan Peak, N. Cachar Hills (*Godwin-Austen*).

The typical species was found by me on Marangsip Peak, Jaintia Hills, at 5350 feet. The species now figured is from the Naga Hills and is the nearest approach I can find to it, yet it differs somewhat, particularly at the columellar margin, which is more oblique.

Kaliella paucistriata, n. sp. (Plate CIII. fig. 10.)

*Locality*. Dikrang Valley, Dafla Hills (*H. H. G.-A.*).

Shell keeled, depressedly pyramidal; sculpture microspiral striation with coarse, irregular, distant, transverse costulation, the same

shown on the basal side; colour very pale ochre; spire moderately high, sides flat; suture shallow. Whorls 5, sides flatly convex; aperture not complete, probably quadrate; peristome thin; columella broken.

Size: maj. diam. 3·8, alt. axis 2 mm.

The form of this shell is very like that of *K. nagaensis*, figured on Plate II. fig. 11 of this work. I give a drawing of the sculpture of the type shell from the Anghami Naga Hills, which shows how very different it is in this character (Plate CIII. fig. 10).

Kaliella richilaensis, n. sp. (Plate CIII. figs. 2, 2 *b*.)

*Locality.* Richila Peak, Bhutan frontier, 10,370 feet (*W. Robert*).

Shell globosely conoid, very rounded below, very narrowly umbilicated; sculpture, transverse distant costulation, rather fine, not regular (fig. 2 *b*); colour pale sienna-brown; spire moderately high, sides flat; apex blunt; suture impressed; whorls 5, keeled on the last, but with no carination, flatly convex; aperture narrowly lunate; peristome thin; columellar margin nearly perpendicular, reflected near the umbilicus.

Size: maj. diam. 3·3, alt. axis 1·8 mm.

Somewhat of the form of *K. nagaensis*; it is, however, a smaller shell and the sculpture is not so fine and regular as in that species.

Kaliella richilaensis, n. sp., var. (Plate CIII. fig. 2 *a*.)

*Locality.* Richila Peak, Bhutan frontier, 10,370 feet.

Shell globosely conoid, not umbilicated, covered with a strong epidermis; sculpture very regular fine costulation; colour strong sienna tint; spire moderately high, conoid, apex rounded; suture shallow; whorls 5, rather flatly convex; aperture narrowly lunate; peristome thin; columellar margin subvertical, but very slightly reflected.

Size: maj. diam. 3·6, alt. axis 2·2 mm.

Kaliella sikkimensis. (Plate CIII. fig. 4.)

*Kaliella sikkimensis*, Nevill MS., Land & Freshw. Moll. Ind. pt. ii. p. 22, pl. v. fig. 9.

*Locality.* Shell now figured is from the Risett chu Valley, South Sikkim (*W. Robert*).

Shell globosely conoid, scarcely perforate; sculpture very fine, close, regular, transverse striation; colour pale sienna-brown; spire conical, less than the major diameter, apex blunt, sides convex; suture moderately impressed; whorls 6, rather convex, closely wound; aperture narrowly lunate, vertical; peristome thin, columellar margin oblique and but slightly reflected.

Size: maj. diam. 1·9, alt. axis 1·6 mm.

This pretty little shell, of which the type described by me is in

the Indian Museum, Calcutta, appears to be fairly numerous in the deep hot valleys of Sikkim.

Kaliella shillongensis, n. sp. (Plate CIII. fig. 5.)

*Locality.* Shillong, Khasi Hills (*H. H. G.-A.*). Two specimens were found.

Shell globosely conoid, very narrowly umbilicated, rounded below; sculpture very fine, regular transverse ribbing; colour umber-brown; spire less than breadth, apex blunt; suture well impressed; whorls $5\frac{1}{2}$, rather closely wound, sides convex; aperture lunate, suboblique; peristome thin, scarcely reflected; columellar margin suboblique.

Size: maj. diam. 2·1, alt. axis 1·4 mm.

Compared with *K. lhotaensis* (Plate V. fig. 2, Vol. I.), this shell is smaller and the whorls much more convex; with typical *flatura*, it is larger, but the whorls do not increase in the same way and in the same proportion; and the same may be said of the very similar shell from the Sikkim frontier, which differs in having a larger body-whorl and larger aperture; they all, in fact, merge into one another.

Kaliella flatura, var. (Plate CIII. fig. 3.)

(*Vide* Vol. I. Plate V. fig. 10, *K. flatura*, G.-A., Munipur.)

*Locality.* Richila Peak, 10,370 feet, on Darjiling-Bhutan frontier (*W. Robert*), also Risett chu Valley and Damsang.

Shell globosely conoid, umbilicated; sculpture very minute, transverse ribbing, only visible under high power, smooth to eye and not so regular on the last whorl as it is on the rest of the whorls; colour pale ochre; spire, sides slightly convex; apex rounded; suture well impressed; whorls 5, very convex; aperture semilunate; peristome thin; columellar margin suboblique and slightly reflected.

Size: maj. diam. 2·25, alt. axis 1·36 mm.

It is interesting to find this minute shell in the Eastern Himalaya, so extremely close in form to that I found in Munipur, the sculpture on the last whorl not being so regular as in the type; it is similar above.

Kaliella bhutanensis, n. sp. (Plate CIII. figs. 7, 7 *a.*)

*Locality.* Damsang, Daling District, Western Bhutan Hills.

Shell conical, perforate, flatly rounded on base, keeled; sculpture microscopic, transverse, irregular lines of growth, these are well shown on the basal side; colour pale dull ochreous; spire high, with convex sides, apex blunt; suture very shallow; whorls 8, closely wound, flat-sided; aperture narrowly quadrate; peristome thin columellar margin short, nearly vertical.

Size: maj. diam. 2·23, alt. axis 1·6 mm.

Its nearest ally is *K. nongsteinensis* (described in Part iii. p. 72, Plate XVI. fig. 2), of the North-western Khasi Hills; but it is broader on the keel in proportion to height of spire and much flatter on the base.

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## Genus Taphrospira, W. T. Blf.

*Taphrospira*, W. T. Blf. P. Z. S. 1904, ii. p. 441.

Original description :—"*Testa depressa vel globoso-depressa, tenuis, cornea, ab illâ* Macrochlamydis *Bs., fossâ spirali extra suturam in omnibus anfractibus tantum diversa.*

"Typus *T. convallata*, Bs. Animal not known.

"So far as is known, the following species should be referred to this genus :—

"*T. convallata*, Bens. Tenasserim. (Conch. Ind. pl. lxxxviii. figs. 2, 3.)

"*T. bathycharax*, Bens. MS. Andaman Islands.

"*T. compluvialis*, Blf. Arakan Hills. (Conch. Ind. pl. lxxxviii. figs. 1, 4.)

"*T. excavata*, n. sp. Hills south of Assam."

Taphrospira bathycharax, Bs. MS. (Plate CXI. figs. 1–1 *f*.)

A close ally of *T. convallata*, Bs.

*Locality*. On the Analokatag Stream, Southern Andaman (*G. Rogers, Esq.*).

Animal ochraceous, dark grey on the extremity of foot; mucous gland overhung by a pointed termination (fig. 1). Sole of foot divided; usual peripodial grooves with a broad margin below.

The right shell-lobe (fig. 1 *a*) is long and fairly broad at base, and in life probably very extensible over the shell. The left shell-lobe (figs. 1 & 1 *d*) is very broad and smooth and must spread over a large surface of the shell. The dorsal lobes are all small, the left in two parts, the posterior situated under the left shell-lobe and distant from the anterior lobe. The wall of the branchial chamber is sparsely spotted. The animal was in an excellent state of preservation, the generative organs at their full maturity (fig. 1 *e*). The most notable thing is the absence of the amatorial organ. The penis is elongate, there is a short kalc-sac contiguous to the junction of the vas deferens, followed by a moderately long epiphallus, up to the penis retractor muscle; there is no cæcum, the tube bends on itself and soon expands into a convoluted mass with an indistinct coiled appearance when looked at with transmitted light, thence it becomes much narrower and leads away towards the generative aperture. The above swollen portion looks as if we had here the representative of the coiled cæcum of *Macrochlamys* much modified

and separated from the retractor muscle. The spermatheca is elongate, and contains three spermatophores beautifully preserved; the walls of the sac were of necessity much stretched and transparent. The uterus and ovo-testis do not call for any special notice.

The spermatophore (figs. 1 *e* & 1 *f*) recalls that of *Austenia gigas*. The flume is very long with a bunch of fine bifid delicate spines at its basal end; for about two-thirds of its length it is straight-edged and spineless, six spines then occur at very equal distances apart, up to the junction of the flume and capsule, which is long and cylindrical, terminating in a thin whip-like appendage, but the cap-like end of the capsule seen in other species is not present in this one. The most striking feature of this spermatophore is the large single antler-like process at the terminal end of the flume, having six points, and these again bifid, very similar in this respect to *A. gigas*.

On page 133 I gave five examples of spermatophores then known. We must now add another, No. 1 *a*, as a variety of No. 1, viz.:—At base of capsule and anterior end of the flume, the intermediate portion being straight-edged with a few spines on one side approaching the capsule.

Jaw (fig. 1 *b*) semicircular, with a central projection.

The radula formula is

$$\begin{gathered} + 18 \ . \ 2 \ . \ 9 \ . \ 1 \ . \ 9 \ . \ 2 \ . \ 18 + \\ + 29 \ . \ 1 \ . \ 29 + \end{gathered}$$

Unfortunately it was broken when extracting it, and the marginals could not be counted.

Central tooth tricuspid, admedian teeth bicuspid, of usual form in *Macrochlamys*.

For a long time the position that shells of this form should occupy has been one of considerable doubt; it was placed provisionally in *Macrochlamys*. *Taphrospira* proves to be a very distinct genus, not only by shell-character, on which Dr. W. T. Blanford founded it, but also still more conclusively on the character of the animal. It is like *Macrochlamys* only as regards the right shell-lobe; the ample left shell-lobe resembles that of species of *Austenia* and *Sophina*. The absence of the amatorial organ is the strongest point which differentiates it from both *Macrochlamys* and *Austenia*. The penis is more like that of *Austenia* than typical *Macrochlamys*, so also is the spermatophore.

The animal of *Taphrospira* had never been sent home before last year. In doing so, Mr. G. Rogers has rendered a very great service to all malacologists interested in the land-shells of the Indian Region; and this was not the only interesting species he collected.

Genus Sarika, nov.*

Type *resplendens*, Phil.

*Orobia resplendens*, Albers, Die Heliceen, 1860, p. 58.
*Nanina* (*Macrochlamys*), G. Nevill, Hand-list, i. p. 20.
For rest of synonymy see Vol. I. p. 109.

Shell depressed, flat on base, smooth, shining; whorls very closely wound and regularly increasing.

Animal with right and left mantle-lobes as in *Macrochlamys*. Generative organs differ, the retractor muscle of the penis is very large and given off directly at the bend of that organ; no coiled cæcum; amatorial organ long, with a rounded terminal knob. Spermatophore spineless.

Sarika resplendens, Phil. (Plate CXI. figs. 3, 3 *a*; Plate CXVI. figs. 2–2 *b*.)

*Macrochlamys resplendens*, Bs.; Godw.-Aust. Proc. Malacolog. Soc. vol. iii. p. 5, July 1899; Pres. Address, pp. 250 & 257.

From the typical locality Mergui, Tenasserim.

Referred to under *Macrochlamys* in Part IV. p. 109, Plate XXVI. fig. 1, shell only, and Part VIII. p. 49, where the animal was described, but the genitalia were not figured; this I now do in order to show more clearly how far it differs from the typical Indian species *M. hardwickei*. External characters, such as the shell-lobes present, led me in 1898, Vol. II. p. 49, to place it in *Macrochlamys*. The generative organs (figs. 3, 3 *a*), it will be seen, differ considerably; it must therefore be considered a distinct subsection forming a link with some other genus. The distribution of true *Macrochlamys* becomes circumscribed, and here in Tenasserim we appear to be near the south-eastern limit of its range. Further material enables me to give a more detailed description of parts of the generative organs. The penis-sheath (Plate CXI. fig. 3) enlarges upwards from the generative aperture to the broad, rather flat and long retractor muscle. The epiphallus is long, and where it is joined by the vas deferens a kalk-sac nearly as long is given off. Within the length of the epiphallus in this specimen a spermatophore was in an advanced stage of development, the sac of which is indicated by the swelling close to the vas deferens. The spermatheca is very long, a narrow tube swelling into an elongate, pear-shaped, thin-walled sac. This contained a single perfectly formed spermatophore. The amatorial organ is very large and thickened, the free end terminating in a very blunt globose knob (fig. 3 *a*). The rest of the generative organs do not call for any special mention.

The spermatophore differs in detail from any I have yet been fortunate to come across (*vide* spermatheca, *Sp.*, Pl. CXI. fig. 3): the

* A Sanscrit female name, *Sāri* or *Sārikā*, and that of the mother of Sakya's chief disciple; so named because her eyes were like those of the Sārus Crane (*Grus antigone*).

flume is very long, quite free of spines on the side, 2 or 3 large ones only at the base of the capsule, which is elongately oval, with very transparent sides and with the usual cap-like terminal end. It is thus on the mould of spermatophores of species of the genera *Girasia* and *Austenia* &c. figured in this work, but shows very interesting variation in minor detail, supporting the conclusion I have arrived at, that this species *resplendens* cannot be retained in *Macrochlamys*, but forms a good and distinct genus, which I name *Sarika.*

In the 'Proceedings of the Malacological Society,' 1899, p. 250, I referred to the unsatisfactory position of this species if retained in *Macrochlamys*, as follows :—

"Passing south-eastward towards the confines of the area I have defined for *Macrochlamys*, we find a change commencing in *M. resplendens* (Section E) of Tenasserim ; we have the shell-lobes still present, but the generative organs are so modified that the coiled cæcum has gone and the male organ is more like that of *Hemiplecta* (*humphreysiana*). In a large Siamese species we find the same features, and I think we are here beyond the range of the Indian type of the genus."

As will be shown further on, the animals of *resplendens* and of the Siamese species are much nearer that of *Xesta* type *citrina*, but the conchological differences are very great. The closely-wound depressed shells of *resplendens* and its allies present characters which cannot be overlooked, and they help considerably in separating this group of the Zonitidæ from *Macrochlamys* on the one hand and *Xesta* on the other.

I have been able to examine two species from Siam, both of which in shell-character approach *resplendens*, Phil., the Mergui shell, particularly in the narrow closely-wound whorls.

The molluscan fauna of Burma, Tenasserim, and the Malay Peninsula is so closely related to that of Siam, I must here refer to these species in some detail. One species was collected by Captain Stanley Flower, the other was collected by Mr. W. Mahon Daly and sent to Dr. W. T. Blanford, who handed it to me. The latter shell was very much broken, and in extracting the animal only the apical part was left, and I was for long unable to determine the species. The animal was soaked out and found to have a well-marked overhanging lobe at the extremity of the foot; a large, rather broad, right shell-lobe; the rest of the mantle-zone was in a decomposed state, and only a portion of the penis was seen. The jaw was dark brown with a central projection. The radula was very interesting, for it recalled that of *Xesta citrina.*

Quite recently I have come across in Dr. Blanford's collection the shell he recorded as *Macrochlamys pumicata*, Morelet, in a paper, "Land and Freshwater Mollusca from Siam," published in the 'Proceedings of the Malacological Society,' part 4, April 1903, based on a collection formed by Mr. W. M. Daly. The remnant in my possession agreed with this shell, but very fortunately the dried-up animal still remained, the foot protruding in a very perfect state.

Mr. Edgar Smith very kindly allowed me to take it home in order to soak it out, with the result that very much more detail has been disclosed. Blanford, p. 275, says :—

"MACROCHLAMYS PUMICATA (Morelet), Journ. Conch. iv. (1875) p. 248, pl. xii. fig. 2.

"A single specimen was sent, which, although very close to Morelet's species, is perhaps not quite identical. Numerous additional shells have been received by Mr. Preston. ['Common in evergreen forest; never found in open or dry forest.'—W. M. D.]"

The animal is dark-coloured.

The mantle-zone was very well preserved (Plate CXVI. fig. 1 *a*) and shows a rather broad and long tongue-shaped right shell-lobe, no left shell-lobe *; the right dorsal lobe large, the left anterior dorsal lobe very small and narrow, the posterior narrower and elongate and separated from the other. The genitalia were in good preservation. A very long cylindrical amatorial organ with blunt terminal knob; the spermatheca a very elongate tube-like sac. The male organ: the description of that of the Mergui *resplendens* will apply to it in every detail, the same strong retractor muscle and similar flagellum.

The radula (fig. 1 *b*) agrees in every respect with the first species examined, having the formula

$$+18 \cdot 1 \cdot 11 \cdot 1 \cdot 11 \cdot 1 \cdot 18+$$

The central and admedian teeth are narrow, plain, straight-sided, and pointed, at the seventh tooth an outer basal notch commences, very minute. The laterals are narrow and bicuspid, the outer cusp far below the point.

The marginal teeth were not in place, so that the total teeth in the row could not be counted; they become very minnte, but are still bicuspid. The jaw (fig. 1 *c*) is rather straight on the edge, with a large central projection.

In the other Siam species the shell is very distinct and appears to be the following :—

SARIKA DOHRNIANA, Pfr. ?

Siam (*Captain Stanley Flower*).

Shell closely wound, somewhat similar to that of *resplendens* of Mergui. Sculpture smooth, no striation to be seen with high powers.

The foot is divided; right and left shell-lobes present, the right rather lower down than in typical *Macrochlamys*.

* This requires verification; such a small flap as this left shell-lobe generally is might very easily become detached, particularly from an animal left for many years in a dried-up state.

In the generative organs only the penis was made out, and proved not to be like that of typical *Macrochlamys.* The retractor-muscle attachment is at the bend, the epiphallus short, a long kalc-sac: it is thus like true *resplendens* of Mergui.

The jaw has a central projection. The formula of the radula is

48 . 2 . 16 . 1 . 16 . 2 . 48
or 66 . 1 . 66.

Central tooth tricuspid, admedian with one outer cusp; laterals bicuspid, point of outer slightly below the inner.

The figure of *Nanina resplendens*, Phil., var. *obesior*, plate 12. fig. 6, in 'Die Preussische Expedition nach Ost-Asien,' also the shell figured in this work, Vol. I. Plate XXVI. fig. 3, as *M. resplendens*, from Siam, are very close to the species which Blanford determined as *pumicata.*

In a paper by Mr. Walter E. Collinge "On the Collections made by Members of the 'Skeat Expedition' in the Malay Peninsula, 1899–1900," Journ. Malacol. 1902, vol. ix. pp. 73–77, a single specimen of *Macrochlamys resplendens* was obtained at Penang, which extends its distribution very much further to the south. The determination was made by Mr. Edgar Smith, who mentions a specimen in the Museum from King Island, Mergui Archipelago. This specimen would be a typical one.

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Considerable interest is attached to the following species. Over twenty years ago I soaked out a dried-up animal I had found in one of the shells of a large Dafla Hill *Macrochlamys*-like form, one of which I had at first (1879) identified erroneously as *lubrica*, a Darjiling species the anatomy of which was also then unknown. The generative organs were not in that complete state I could have wished, and they were so very different from any I had at that time seen, I put the drawings by, trusting I might get better material to work on from that part of India; but in that hope I was disappointed. Quite recently (July 1906), on going over these Dafla shells, I discovered another dried-up animal, which, after soaking for a month, I have been able to examine and was surprised at the perfect state of its preservation. The outer integument was as tough as the day it was taken, the colour unchanged.

The shell of this species is another instance of how shell-character may be misleading in classification. So like is it to many species of true *Macrochlamys*, any conchologist would place it in that genus. I did so myself provisionally on Plate XXI. fig. 6 of this work in January 1883, under the title *M. daflaensis.*

The very first time I took this species alive I noticed the absence of the mucous gland at the extremity of the foot and made a careful drawing of it in my note-book, which I now reproduce. In

the second specimen dissected the form of the foot was perfect, and confirms my field-note in the most satisfactory way; because there was just a doubt I had been deceived about the mucous gland, which my friend Dr. Blanford had suggested, for it is not always in life so very well seen when covered with mucous and the animal swollen in wet weather.

In a paper I wrote on the Helicidæ (Zonitidæ) collected during the expedition into the Dafla Hills, Assam (Journ. Asiat. Soc. Bengal, vol. xlv. pt. 2, p. 311, 1876), occurs the first notice of this species :—

" Helix lubrica, Bs.? (Plate viii. fig. 9.)

" Until I had examined the animal I should have supposed it to possess the usual truncate glandular form at the extremity of the foot. It shows how carefully we should examine the living animals before grouping these very similar forms of Helicidæ, and how much has to be done in this direction. I give a description and drawing of this species.

" *Animal.* Fore part of foot and head, as well as the tentacles, dark slate; extremity of foot pointed (no gland visible), pale grey, edged light fleshy; sole of foot dark orange; mantle very slightly reflected in front, with no tongue-shaped process,—it is in fact very similar to that of *Vitrina.*

" Length 2·0″; tentacles 0·5″; shell, major diam. 0·95″.

" *Habitat.* Shengorh Peak, 7000 ft."

The only part of this original description which was wrong relates to the tongue-shaped process or *shell-lobes*: these were seen to be present in the second specimen soaked out; they are small, particularly the right, and might easily be overlooked in life. The animal had clearly a pointed foot, not divided below as in *Macrochlamys*, with an indistinct central fold, no peripodial grooves, very dark grey, a rather smooth surface with a pale narrow peripodial border.

From the two soaked-out specimens I have been able to make out much more of the genitalia than the first alone presented, which was incomplete.

The generative organs are most interesting and fall in with the dissimilarity to Zonitoid genera, such as *Macrochlamys*, presented in the external characters. They are altogether different from any species of Indian Land Mollusca I have hitherto seen, particularly in the form of the dart-sac. The penis is a simple tube bent on itself near the short retractor muscle. The spermatheca is long and ample. The oviduct in both cases was destroyed, but in the second specimen the junction of the vas deferens was intact. The dart-sac is short, rounded at the distal end, and on being opened out a blunt leathery solid dart was disclosed. Attached to the head of the dart-sac at its central point is a tube of great length: in the first specimen this is thin at first, then swelling out much larger in several coils, and again becoming thinner; in the second specimen this rope-like tube is more uniform in size, much coiled together

where it is attached to a glandular mass, this was much broken up, but a large portion was seen enveloping a part of the spermatheca.

This long rope-like attachment to the dart-sac, which in the first specimen had no attachment, left very much that was doubtful as to what it could be ; the second specimen clears this up, and we are presented with an amatorial organ similar in its main points to that met with in the genus *Dyakia*, particularly in that of *D. striata* var., lately described by me in the 'Proceedings of the Malacological Society,' vol. vii. part 2, June 1906. This is an extremely interesting point of resemblance—confined to one organ, and yet not shared in by several important characters. In *Dyakia* there is a large mucous pore, and the peripodial margin is fringed as in the Zonitidæ generally. There are no shell-lobes either. There are minor details in the genitalia which may be noted : the spermatheca in *Dyakia* is very small, the dart is calcareous. The radula is of the same type in both, the laterals being aculeate. The penis in both is of the same simple type. The radula of the Dafla form has 98 rows of teeth and the formula

$$\frac{55 \;.\; 1 \;.\; 12 \;.\; 1 \;.\; 12 \;.\; 1 \;.\; 55}{68 \;.\; 1 \;.\; 68}$$

The centre tooth is tricuspid, the admedian teeth also tricuspid, the inner cusp high up, the outer one lower down ; the 13th tooth has no notch. All the laterals are shortish aculeate teeth, becoming very small on the margin.

The jaw is large, solid, convex on the edge, and rather straight in the centre as opposed to the usual central projection.

This species is so distinct both in external and internal known characters that I have to create a new genus for its reception. The points in which it resembles *Dyakia* are outweighed completely by others, such as the form of the foot. I name it Staffordia, after Brigadier-General Stafford, who was in command of the punitive force which entered the Dafla Hills for the first time in the winter of 1874–75, and I have great pleasure in connecting his name with one of the many new species I collected when serving under him.

### Staffordia, nov. gen. (Plate CXIII.)

*Animal.* Foot pointed, peripodial margin simple with a narrow pale margin ; right and left shell-lobes present, both small. Generative organs : dart-sac small, globose, with a long cord-like attachment to a coronal gland ; penis simple ; spermatheca long. Radula with aculeate laterals.

The Dafla Hills, in which this very aberrant mollusk was found, lie on and north of lat. 27° and between long. 93° 10′ and 93° 50′ E., at the base of the Eastern Himalaya. Nothing like it has been as yet found in any part of India or Burmah.

STAFFORDIA DAFLAENSIS, G.-A. Shengorh Peak, 7000 feet. (Plate CXIII. figs. 1–1 *i*.)

Shell depressedly tumidly conoid, umbilicated, solid, rather flat on base. Sculpture very regular, longitudinal, sharply defined, broad-ridged ribbing. Colour rich olivaceous with ochre tint. Spire low, sides convex. Suture shallow, adpressed. Whorls 6, rapidly increasing, the last rounded; aperture broadly ovate, oblique, milky white within; peristome acute, sinuous above and slightly so below, much reflected at umbilical margin. Columellar margin very oblique and descending.

| | Major diam. | Minor diam. | Alt. axis. | Alt. b.-w. |
|---|---|---|---|---|
| Largest size: | 23·5 | 20·0 | 9·4 | 7·8 mm. |
| Smaller size: | 18·8 | 16·2 | 8·0 | 5·8 ,, |

It was an abundant species in the Dafla Hills, varying much in colour and size, often being of a pale ochraceous-grey tint. On Toruputu Peak it occurred also with the same characteristic sculpture, but thinner in structure.

One very globose example was found on this same peak.

STAFFORDIA DAFLAENSIS, var. (Plate CXIII. fig. 2.)

Shell: sculpture coarse longitudinal ribbing, rather irregular. Colour ochraceous olive-green.

Size: maj. diam. 16·4, min. 14·8; alt. axis 8·0, alt. b.-w. 6·5 mm.

*Macrochlamys shengorensis*, G.-A., described and figured in Vol. I. p. 102, Pl. XXII. fig. 5, is the young of *Staffordia daflaensis*, G.-A.

A globose shell with oblique columellar margin, which may be an ally of *S. daflaensis*, was found on Toruputu Peak. The sculpture differs much, being smooth with indistinct striation; and as the animal might prove quite different I have distinguished it as *toruputuensis*.

STAFFORDIA ? TORUPUTUENSIS. (Plate CXIII. fig. 3.)

Shell not fully grown; sculpture very smooth, with a thick shining epidermis with indistinct striation; colour light ochraceous olive-green.

Size: maj. diam. 16·5, min. 14·0; alt. axis 7·25.

The following species, of which I have only one specimen, differs so much that I have thought fit to distinguish it by name—the sculpture alone is so very different from those described above. A larger series, of full growth, is required to settle these differences.

STAFFORDIA STAFFORDI, n. sp. Toruputu Peak, Dafla Hills, at 7000 feet. (Plate CXIII. fig. 4.)

(Vol. I. part iii., January 1883. Sculpture figured, Plate XXI. fig. 14, × 50.)

Shell: umbilicus almost hidden, moderately solid, with a thick

epidermis, very globosely conoid, rounded below; sculpture small, elongate papillæ arranged longitudinally, and differing from all the other species collected in the Dafla Hills (Plate XXI. fig. 14); colour olivaceous ochre; spire low; suture shallow; whorls 5, sides convex above, rather flattened on the periphery of the last whorl; aperture lunate, narrow, subvertical, milky white within, rounded below; peristome thin, slightly sinuate below, and nearly vertical near the columella.

Size: maj. diam. 15·2, min. 13·2; alt. axis 7·8, alt. b.-w. 6·0 mm.

The shell is not adult, but the sculpture is so peculiar I have been obliged to designate the species, which I have named after the Brigadier-General who commanded the Expedition *.

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## Genus Euplecta.

(*Continued from* Vol. II. p. 104.)

Euplecta hyphasma, Pfr. (Plate CXIV. figs. 1, 1 *a*.)

*Helix hyphasma*, Pfr. P. Z. S. 1853, p. 124; id. Mon. Hel. vol. iv. p. 40; Reeve, Conch. Icon., *Helix*, fig. 1297; Hanley, Conch. Ind. p. 25, pl. liv. fig. 3.

*Sitala hyphasma*, Theob. Suppl. Cat. p. 20.

*Nanina* (*Sitala*) *hyphasma*, Nevill, Hand-list, i. p. 34.

Original description:—" H. *testa vix perforata, trochiformi, tenui, confertim radiato-striata, sulcis remotioribus spiralibus quasi tecta, pellucida, corneo-albida; spira subconcavo-conica, acutiuscula; sutura marginata; anfractibus* $7\frac{1}{2}$, *convexiusculis, ultimo convexiore, compresso-carinato, non descendente, basi convexo, nitido, sublævigato; apertura obliqua, rhombeo-lunari; peristomate simplice, recto, margine columellari substricte descendente, superne vix dilatato, reflexiusculo.*

" Diam. maj. 15, min. $13\frac{1}{2}$; alt. $10\frac{1}{2}$ mill.

" *Hab.* in insula Ceylon (*Thwaites*)."

Specimens in formalin were sent me by Mr. O. Collett from Ambagamuwa, Ceylon.

The animal is pale-coloured; length of foot shrunk up to 5 mm.; the dorsal lobes are quite black, and a patch of the same colour is conspicuous on both sides of the neck and near extremity of the foot; the pallial margin is broad, the integument covering the branchial chamber is black with some white patches (when the shell is removed it is at once apparent); the mantle-zone has no shell-lobes.

The jaw has a slight central projection.

* While these pages were passing through the press another specimen of this species was received among a collection of shells kindly sent me for determination by Mr. N. Annandale from the Calcutta Museum.

The radula, which was extracted quite perfect, has the formula

$$\frac{48 \;.\; 1\; 10 \;.\; 1 \;.\; 10 \;.\; 1 \;.\; 48}{59 \;.\; 1 \;.\; 59}$$

81 rows of teeth.

The centre tricuspid, the median with a cusp on the outer side; the laterals bicuspid, with points even; about five of the smallest outermost laterals are tricuspid.

When the animal is withdrawn into the shell the heart is seen situated at the distance of one whorl from the aperture, on the front lower portion of the last whorl.

In the genitalia (fig. 1) the male organ is a modified form of that of *Euplecta binoyaensis* (Plate XCVII.), only that the loop is not present, while the muscular cæcum is longer; in the second specimen dissected, and from which the figures are taken, the spermatophore in process of development (fig. 1 *a*) is of the same type. The amatorial organ is present.

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## Subgenus Ravana, Godwin-Austen.

In Part IV. (October 1883) of this work I figured a Ceylon shell, Plate XXVI. fig. 6, as *Macrochlamys? politissima*, Pfeiffer. In 1901 I received from Mr. O. Collett a specimen in spirit of this species collected at Watawala, 3500 feet. The shells agree in size and form. In May 1901 I made a dissection of the animal, and published the results in the 'Proceedings of the Malacological Society of London,' read on 14th June, 1901, appearing in vol. iv. pt. 6, p. 261, pl. xxvi. figs. 1–6. It was found to have no sort of relationship to *Macrochlamys*, but to be close to *Ariophanta*, yet so distinct from the type species, *A. lævipes*, that I created the subgenus *Ravana* for its reception.

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## Family ENDODONTIDÆ.

At the end of Part IX., pp. 139, 140, I alluded to the genus *Philalanka*, and stated that *Thysanota crinigera*, Bs., *T. biciliata*, Pfr., and *T. hispida*, Sykes, are closely allied to this genus. I am now able to give full details of the study of these species.

Among those who have done excellent work collecting and preserving the animals of the Ceylon land-mollusca I must especially mention Mr. Oliver Collett, of the Binoya Estate, Watawala, whose early death in 1902 we have to deplore; his knowledge of the molluscan fauna of the island was very considerable. The specimens

he sent home to me were most carefully selected and labelled with character of the habitat &c. For their preservation he used formalin, and this I found is admirably adapted for both large and small specimens.

Mr. H. B. Preston's name must not be omitted in connection with Ceylon collections.

Collett's valuable labour has led to our gaining very considerable knowledge of the land-shells of the island and their representatives on the mainland of Southern India. The results have been published by Mr. E. R. Sykes and others, including Collett himself. The anatomical details have given us a far greater insight into generic relationships.

Among the first species thus sent home was a new small *Sesara*-like shell for which I created a new subgenus *Philalanka** (from "Lank" or "Lanka," the well-known name of Ceylon), placing it in the family Endodontidæ, for in its general anatomy *P. secessa* came nearest to the few species of that family which have been examined. The shell, however, differed sufficiently from that of any subgenus mentioned by Pilsbry that a new subgenus became necessary. It is the first record in the Indian Region of this family, so characteristic of the Southern Hemisphere.

Since the publication of the above paper (1898) I have been able to examine other species having a marked similarity to *Philalanka secessa*. The first was *thwaitesi*, leading on to *Thysanota* (*Sykesia*) *biciliata* and *Thysanota crinigera*. What is of great interest is finding that the characters presented to us in these species go far to show a wonderful similitude and approach to the animals of *Corilla* and *Plectopylis*. I have been led to consider sufficient grounds exist for the creation of a subfamily, the Thysanotinæ of the Endodontidæ, embracing these Indian genera.

Subfamily Thysanotinæ.

| | |
|---|---|
| 1. Thysanota, Albers (1860) ...... Proc. Malacol. Soc. p. 72, pl. v. figs. 17, 18. | 1. *guerini*, Pfr. Type. Southern India. |
| | 2. *hispida*, Sykes. Ceylon. |
| | 3. *crinigera*, Benson. Southern India. |
| | 4. *eumita*, Sykes. |
| 2. Philalanka, G.-A. (1898) ... | 1. *secessa*, G.-A. Type. Ceylon. |
| | 2. *bolamputtiensis*, G.-A. Southern India. |
| | 3. *thwaitesi*, Pfr. |
| | 4. *circumsculpta*, Sykes. |
| | 5. *floweri*, G.-A. |
| 3. Sykesia, Gude .................. 'Science Gossip,' vol. iii. (1897) pp. 300–332. | 1. *clathratula*, Pfr. Type. Ceylon. |
| | 1 *a*. Ditto, var. *compressa* (Proc. Mal. Soc. vol. iii. (1898) p. 72, pl. v. figs. 13, 14). |
| | 1 *b*. *caliginosa*, Sykes, Proc. Malacol. Soc. vol. iii. (1898) p. 72, pl. v. figs. 21, 22. |
| | 2. *retifera*, Pfr. |
| | 3. *biciliata*, Pfr. |
| | 4. *euliginosa*. |

* "On *Philalanka*, a new Subgenus of *Endodonta*, with Descriptions of two new Species from the Indian Region," Proc. Malacol. Soc. vol. iii. pt. 1 (April 1898), p. 11, pl. i.

## Subfamily Thysanotinæ.

### Genus Thysanota, Albers.

*Thysanota*, Albers, Die Heliceen, p. 63 (1860) (type *Nanina guerini*, Pfr.: Nilgherries); Theobald, Suppl. Cat. p. 26 (1876); Nevill, Hand-list, i. p. 54 (1878).

Thysanota crinigera, Benson. (Plate CXII. figs. 2–2 *d*.)

*Helix crinigera*, Benson, A. M. N. H. 1850, ser. 2, vol. v. p. 214; Pfr. Mon. Hel. vol. iii. p. 112; Reeve, Conch. Icon. fig. 746; Hanley, Conch. Ind. p. 27, pl. lx. fig. 7.

*Trochomorpha crinigera*, Theob. Suppl. Cat. p. 23.

Original description:—"*Testa anguste umbilicata, depresso-trochiformi, cornea, radiato-costulata; apice obtusiusculo; anfractibus 6–6½, vix convexiusculis, linea unica elevata supersuturali munitis; ultimo carinato, carina suturaque pilis elongatis ciliatis, basi planiuscula, ad umbilicum compressiuscula, lineis impressis concentricis frequentibus ornata; apertura obliqua angulato-lunari, securiformi; peristomate simplici, acuto.*

"Diam. major 12½, minor 12, alt. 6½ mill.

"*Hab.* ad latus montium 'Nilgheries' versus Orientem spectans. Teste Jerdon.

"This shell in size and characters is intermediate between *Helix guerini*, Pfr., an inhabitant of the summits of the Nilghery Mountains, and *H. retifera*, Pfr., which inhabits the warmer valleys of the same range according to Dr. Jerdon, to whom I am indebted for specimens of all the three species from the localities indicated."

When making a list of species in my collection preserved in alcohol, I found a single specimen of *Helix crinigera* sent to me some years ago by Colonel Beddome. This had been put on one side in the hope of obtaining further specimens; for the shell being a fine one I did not like to destroy it and perhaps find the animal, as is so often the case, in a state in which very little can be made out. With Mr. Collett's material in hand, it has at last been examined and has proved to be a most interesting and valuable specimen, being in excellent preservation. It clears up the position of a group of land-shells which had, until now, a very undefined one.

*Animal* (fig. 2). Has a pointed foot; no gland. A wide well-marked pallial margin, paler than that of the foot above. The buccal mass and intestine, with the salivary gland, was well seen (fig. 2 *d*); and the jaw and radula were got out complete. The first (figs. 2 *b*, 2 *c*) is long and narrow, thin, with a slightly concave central portion. Under a high power, the jaw is seen to be made up of a number of narrow vertical plates coalesced together, which may

be termed a multiplacognathous jaw. The radula (fig. 2 *a*) has this arrangement of the teeth:—

$$21 \ . \ 21 \ . \ 1 \ . \ 21 \ . \ 21$$
$$42 \ . \ 1 \ . \ 42.$$

The centre tooth is small, straight-sided, with no basal cusps, on a long narrow oblong plate. Up to the 10th admedian the teeth are similar in form; there is only an indication of an outer cusp. At the 20th this outer cusp is more pronounced, and is retained even in the outermost laterals or marginals, represented by the minute tooth on the outer side of the two large double teeth. At the 18th tooth an inner upper cusp is also seen, which rapidly becomes nearly evenly bicuspid up to the outermost laterals. The plates of these last are narrower and square in shape. This radula at once recalls that of *Philalanka*.

Nevill, in the Hand-list of the Indian Museum Collection, Calcutta, placed in the genus *Thysanota* the following species:—*guerini*, Pfr. (=*crinigera*, Bs.), specimens from the Nilghiris and Tinnevelleys; *tabida*, Pfr., Nilghiri Hills.

In his MS., 2nd edition, he brought into the catalogue three more species in the collection:—(1) *crinigera*, which he appears afterwards to consider distinct from *T. guerini*, obtained by Col. Beddome and Dr. Blanford from the Anamullays, Aggamullays, and Nilghiris respectively; (2) *hyba*, Benson, from Dakhin Khoond near the Sutlej River, with the note "Rather scarce near Dalhousie and Chamba over 6000 ft., *fide* Theobald, J. A. S. B. 1878" (caret in pencil); (3) *biciliata*, Pfr., Ceylon (caret in pencil).

Thysanota hispida, Sykes.

*Thysanota hispida*, Sykes, Proc. Malacol. Soc. Lond. vol. iii. No. 3, Dec. 1898, p. 160, pl. x. figs. 2 *a–c* (paper read June 1898).

Original description:—"*Testa trochiformis, periostraco fusco, rugoso, induta, basi impressa, umbilicus angustus, pervius; apex mediocris, applanatus; anfr.* 6–6½, *convexi, lira unica spiraliter sculpti, ultimus basi carinatus, lira carinaque pilis longis densæ notatæ, apertura lata, lunaris; peristoma simplex, marginibus callo tenuissime junctis.*

"Diam. max. 8, alt. 5 mm.

"*Hab.* Haputale, at 4500 ft.; Ceylon (*O. Collett*).

"This species appears to be closely related to *Thysanota guerini*, Pfr., from the Nilgherries, but differs somewhat in shape, as also in size; the single spiral thread clothed with club-shaped hairs (fig. 2 *c*) is specially noteworthy. The basal carination is continued, and marks the suture of the upper whorls."

Subgenus Philalanka.

*Philalanka*, Godw.-Austen, Proc. Malacol. Soc. Lond. vol. iii. pt. i. pp. 11–13 (April 1898). Type *P. secessa*, pl. i. figs. 1–5.

Original description of the subgenus:—"Jaw composed of numerous

squarish plates. Basal plates of teeth of the radula square or oblong; central teeth tricuspid, laterals multicuspid. No mucous gland at extremity of foot. Generative organs simple. No amatorial organ and no accessory organs. Shell small, many-whorled, pyriform or trochiform with a single liration, unicoloured."

PHILALANKA SECESSA, Godw.-Aust.

Original description:—" Shell pyramidal, base convex, narrowly umbilicated. Sculpture fine, irregular, costulate transverse lines; a single lirate band follows the angulation of the whorl throughout, with another on and above the suture; on the under side an exceedingly fine striation may be seen with a high power (× 60). Colour pale ochraceous, with a greenish tinge. Spire conic, sides nearly flat; apex blunt. Suture shallow, with a thread-like liration. Whorls 8, narrow; sides very slightly convex below the liration, flat from that to the suture. Aperture semilunate, narrow, vertical. Peristome thin, slightly reflected on the columellar side, which is suboblique.

" Size: major diam. 7, alt. axis 6 mm.

" *Hab.* Ambegamuwa, Ceylon, 3000 ft. (*O. Collett*)."

This very interesting species was found among dead leaves in the forest; and to Mr. O. Collett is due the credit of being the first to collect a form which enables me to show the occurrence in India of a group of shells not hitherto recorded from any part of that region. Nothing like it has been found to the east of the Bay of Bengal, on the North-east Frontier, or in Burma; but the possibility of its being a casual introduction is removed by the discovery of another allied species, in the south of the Indian Peninsula, by Colonel Beddome.

I have examined two specimens which were preserved in spirit.

The animal has a distinct peripodial groove and broad pallial margin, with a fringe-like structure, very colourless in contrast with the foot above; but it has no mucous pore. The right dorsal lobe is large, with a very pale, narrow outer margin; the left rather narrow, its widest portion being in the middle; both are darker than the foot of the animal, which is pale grey with a paler margin. The sole is not divided. The salivary glands, disposed in two long masses on either side of the œsophagus, are of a dark tint.

The generative system is simple and devoid of accessory parts; the male organ is sharply bent on itself near the generative aperture, the retractor muscle being given off low down from the second bend. It thence narrows, becoming gradually whip-like, into the long vas deferens, forming a long loop in a backward direction, and returning as usual to pass between the retractor muscles of the eye-tentacles. The male organ, as far as the loop, is solid, pink in colour, and conspicuous on dissection. At the anterior end it terminates in a bluntish knob. The spermatheca is globose, with a thin stalk-like tube which joins the vagina high up, and, connected with it, passes downwards into the common sheath of the vagina.

The jaw was only seen in the second specimen examined; it corresponds with that of the family Endodontidæ, and was exceedingly fragile, consisting of a number of thin oblong plates, overlapping each other. This single jaw was not complete, and I could only get two drawings of separate portions, one being a side view of eight or nine plates.

The odontophore was equally interesting and showed the same affinities. The plates of the central teeth are square in shape, the rhachidian being the narrowest; they increase outwards in breadth until the laterals are very broad, low, and oblong, whilst on the outermost the cusps are difficult to detect and very irregular. The centre tooth has a large pointed mesocone, with two basal cusps; the median teeth up to the eleventh are similar in shape, but with only one cusp on the outer side; the next, the twelfth, shows an inner side cusp; in the thirteenth and fourteenth the mesocone is smaller, with two equal-sized side cusps rising from the upper side of the plate. In the succeeding teeth there is a good deal of irregularity in profile, but the side cusps are split into two, now and then three, the centre still remaining the longest or nearly the longest. The dental formula is

20 . 2 . 10 . 1 . 10 . 2 . 20

or 32 . 1 . 32

I have received from Mr. Collett, from the Ambegamuwa District of Ceylon, specimens in formalin named *Microcytis thwaitesi*, Pfr., and *M. suavis*, Jousseaume. The tube containing *suavis* bears this remark: "I have sent Mr. Sykes Dr. F. Jousseaume's type of this species." Mr. Sykes, in a paper on Ceylon Land-Shells, Journ. Malacol. Soc. London, vol. iii. no. 2, p. 65 (1898), refers to these species; and I cannot do better than quote the conclusion he came to:—"Pfeiffer, in 1853, described * *Helix thwaitesi*, and Reeve gave a figure of it † drawn from an example in the original type series; Dr. Jousseaume, in 1894 ‡, described *Microcystis suavis* from Nuwara-Eliya. I have examined specimens said to have been identified as *M. thwaitesi* and *M. suavis* by Dr. Jousseaume, and also Pfeiffer's types, and come to the following conclusion: that Dr. Jousseaume's *M. thwaitesi* is not that species, but is my *Macrochlamys circumsculpta*; while his *M. nuwara* is really *M. thwaitesi*, as is also his *M. suavis*. This latter appears to be a variety, with the spire a little more depressed, the umbilicus a trifle larger, and the mouth slightly different in shape; it may be of varietal, certainly not of specific rank."

The specimen labelled *M. thwaitesi* sent by Mr. Collett agrees in every way with *M. circumsculpta*, and I shall describe the animal under this last title.

The result of my examination of these molluscs has proved

* Proc. Zool. Soc. 1853, p. 125.
† Conch. Icon., *Helix*, sp. 1336.
‡ Mém. Soc. Zool. France, vii. p. 10, pl. iv. fig. 3.

somewhat of a surprise to me. It was a satisfaction to discover at last the type of their anatomy, and that they are closely related to, and can be placed in, the genus *Philalanka.*

PHILALANKA THWAITESI, Pfr. (Plate CXII. figs. 1–1 *c*.)

*Helix thwaitesi*, Pfr. P. Z. S. 1853, p. 125.

*Helix nuwara*, Jousseaume, Mém. Soc. Zool. France, vii. p. 10, pl. iv. fig. 3.

*Helix suavis*, Jousseaume, loc. cit.

*Helix thwaitesi*, Pfr. Mon. Hel. vol. iv. p. 50; Reeve, Conch. Icon. fig. 1336; Hanley, Conch. Ind. p. 52, pl. cxxviii. figs. 7–10.

*Macrochlamys* (sec. D) *thwaitesi*, Theob. Suppl. Cat. p. 19.

*Microcystis suavis*, O. Collett, Journ. R. Asiat. Soc. Ceylon, vol. xv. (1897).

Original description :—" *Testa aperte perforata, convexo-depressa, striatula, nitida, cereo-hyalina; spira breviter conoidea, obtusula: sutura profunda, submarginata; anfr.* 6½, *convexi, arcte convoluti, ultimus non descendens, basi inflatus; apertura verticalis, lunaris; perist. rectum, acutum, margine columellari arcuatim oblique descendente, ad perforatione vix dilatato.*

" Diam. maj. 5, min. 4½, alt. 3 mill.

" Habitat in Insula Ceylon.

*Shell.* Seven faint longitudinal lines can be counted on the first whorl.

*Animal.* This was beautifully preserved in the formalin—a medium which seems eminently adapted for minute forms. The foot is long and narrow, pointed behind, and presents no mucous gland. The mantle-margin was rather swollen and indistinct, but there were no shell-lobes. The jaw and radula were extracted quite perfect. The first (figs. 1 *a*, 1 *b*) is thin and delicate, polyplacognathous, slightly curved, consisting of 12 quadrate plates, slightly overlapping each other on the side; the two outermost very small and narrow. The teeth of the radula (fig. 1 *c*) are arranged:

22 . 1 . 8 . 1 . 8 . 1 . 22
31 . 1 . 31

The central tooth is tricuspid, its side cusps small. The admedian have one long tooth, with a side tooth rather remote from it on the outside; this in the ninth is small. The laterals at once differ at the tenth tooth in having two nearly equal, suboblique, close-set, parallel teeth, and one shorter, contiguous to them outside; these pass into others, with three parallel very straight teeth set oblique to the quadrate plate, the outer one slightly shorter than the two inner, finger-like in form. Towards the margin the teeth become very minute, only two generally to be seen, and in about four of the outermost only the oblong narrow plate can be made out.

Genitalia of the same type as in *P. secessa*. The male organ is a

long tube, tapering backward from a knob-like swelling at the generative aperture; the vas deferens unites with it at the end, bending over just above where the retractor muscles fringe, as it were, the main sheath. The vas deferens is an extremely fine thread, but becomes larger as it approaches its junction with the oviduct.

The spermatheca is very ample and lengthened, rather swollen towards the posterior end. In this respect it differs from that of *P. secessa*, which is a globose sac terminating a long narrow tube. Another difference may be noted in the retractor muscle of the male organ: in *secessa* it is low down towards the generative aperture; in this species it is higher up. But it is possible, and I think even more than probable, that similar fine muscle-attachments exist in *secessa*, but in these small forms minor details of this sort are difficult to see, and likely to be destroyed or rendered brittle in the preservative medium.

Under *Microcystis suavis*, Mr. O. Collett writes *:—" This species occurs sparingly here. The animal, when alive, gives a dark olive tint to the transparent shell. This is from the dark colour of the integument covering the branchial chamber and the neck-lobes. Habitat among ferns and moss in shady localities."

PHILALANKA CIRCUMSCULPTA, Sykes.

*Macrochlamys ? circumsculpta*, Sykes, Proc. Malacol. Soc. Lond. vol. ii. no. 5, p. 235, July 1897, pl. xvi. figs. 3, 4; vol. iii. no. 2, p. 65 (1898).

Original description :—" *Testa perforata, convexo-depressa, nitida, cereo-hyalina; spira breviter conoidea, apice obtusa; sutura impressa; anfr. 5, convexi, arcte convoluti, obsolete spiraliter lirati, ultimus non descendens, basi inflatus; apertura lunaris; peristoma rectum, acutum, margine columellari ad perforationem dilatato, subreflexo.*

" Diam. max. 5, min. 4·7 mm.; alt. 2 mm.

" *Hab.* Watawala, Ceylon (*Collett*).

" This species is nearly related to the *Helix thwaitesi* of Pfeiffer (which is also obsoletely spirally lirate), but may be at once distinguished by the fact that its breadth is greater in proportion to the number of whorls. The umbilicus is also slightly smaller in the present species, the spire is not so much raised in proportion, and the nucleus is larger. The sculpture is stronger than in *Helix thwaitesi*, and a few of the stronger lines of growth intersect the revolving liræ, thus giving the shell a decussated appearance under a lens."

In the specimen preserved in spirit which I dissected there were five distinct lirate lines on the whorl, the three next to the suture being the strongest. The specimen was a very fine one, measuring 5·75 mill. major diam., 5 minor diam.

The mantle-zone and covering of the visceral sac is quite black, with a chocolate tint. There are no shell-lobes. The right dorsal

* Journ. R. Asiat. Soc., Ceylon Branch, vol xv. (1897).

is small and triangular; the left dorsal narrow, in two parts. On breaking away the shell, two embryonic shells were brought into view, very immature; the future shelly covering was in the stage of minute disconnected particles, arranged over the globose mass.

The radula was not perfect. I counted the admedian teeth, but not the laterals:

$$+ 12 . 1 . 12 +$$

The laterals are exactly as in *Philalanka thwaitesi*—elongate, tricuspid, and finger-like (*vide* Plate CXII. fig. 1 *c*).

PHILALANKA FLOWERI, n. sp. (Fig. 1.)

Batu Caves (*Captain Stanley Flower*).

Shell globosely conoid, smooth, shiny, scarcely perforate, rounded below; sculpture indistinct transverse lines of growth; colour pale ash; spire somewhat depressed, blunt; suture angulate. Whorls $6\frac{1}{2}$, the last with two strong spiral raised lines; one on the upper whorls, the side nearly vertical below it. Aperture lunate, angulate on upper outer margin; peristome thickened; columellar margin subvertical, strong, not reflected.

Size: maj. diam. 3·0, alt. 2·8 mm.

Its nearest and close ally is *Sitala carinifera*, var. *marangensis* of Aldrich, described from Marang in Sumatra ('The Nautilus,' May 1898, p. 2). *Floweri* is, however, a more tumid shell and much more globose below. The Sumatran shell will stand as *marangensis*; it has no close affinities with *carinifera*, Stoliczka.

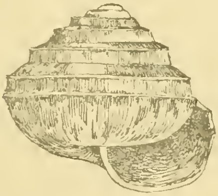

Fig. 1.—*P. floweri*, × 9.

Fig. 2.—*P. batuensis*, × 9.

PHILALANKA BATUENSIS, n. sp. (Fig. 2.)

Shell depressedly conoid, narrowly umbilicated; sculpture nearly smooth, slightly striate transversely; colour whitish (shell not fresh). Spire low, conoid, apex obtuse; suture simple, with two thread-like ribs above. Whorls 5, increasing gradually, the last slightly subangulate, with one rib on the periphery, making it tricarinate on the last whorl. Aperture quadrate, wider than high; peristome thin on outer margin; columellar margin vertical, slightly reflected.

Size: maj. diam. 2·5; alt. shell 2, alt. axis 1·5 mm.

This shell is distinct from *Sitala carinifera*, Stoliczka, Penang

Hill, described in Journ. Asiat. Soc. Bengal, vol. xlii. pt. 2, 1873, p. 16. It is not so pyramidal, the aperture is not so lunate, but it is similar in being tricarinate. The type of *carinifera* is in the Calcutta Museum: Nevill, Hand-list, i. p. 33, as *Nanina* (*Sitala*).

### Genus Sykesia.

Sykesia biciliata. (Plate CXII. figs. 3–3 *c*.)

*Helix biciliata*, Pfr. P. Z. S. 1855, p. 112; Pfr. Mon. Hel. vol. iv. p. 68; Hanley, Conch. Ind. p. 64, pl. clix. figs. 1–4.

*Hemiplecta* (sec. A) *biciliata*, Theob. Suppl. Cat. p. 21.

*Sykesia biciliata*, Sykes, Proc. Malacol. Soc. London, vol. iii. p. 169 (1898).

*Plectopylis* (*Sykesia*) *biciliata*, Gude, 'Science Gossip,' No. 61, vol. v. June 1899, pp. 16, 17.

*Nanina biciliata*, Pfeiffer, Malak. Blätt. ii. 1855, p. 121.

*Discus biciliata*, H. Nevill, Enum. Helic. Ceylon, 1871, p. 1.

*Nanina* (*Hemiplecta*) *biciliata*, Pfeiffer, Vers, p. 121.

Mr. G. K. Gude, in his paper on "Armature of Helicoid Land-Shells and new Species of *Plectopylis*," published in 'Science Gossip,' writes of this species *biciliata* as follows (under the subgeneric title of *Sykesia*), in June 1899:—"The systematic position of this shell remained uncertain for a long time; it was placed in *Nanina* by Dr. Pfeiffer (Malak. Blätter, ii. 1855, p. 121) and in *Discus* by Mr. H. Nevill (Enum. Helic. Ceylon, 1871, p. 1), while finally Mr. S. Clessin grouped it with *Macrochlamys* (Nomencl. Helic. Viv. 1881, p. 45). It is unfortunate that Dr. Pfeiffer's types of this species cannot be found. They were described as from the late Major Skinner's collection, but Miss Linter, who purchased the entire collection, kindly informs me that the shells in question are not in it, and she does not think that Major Skinner ever possessed them, there being no record of them in his Catalogue. Mr. Edgar Smith has obligingly searched the British Museum Collection for these types, but without success. The species appears to be rare, for since it was first discovered it has remained unobserved until Mr. H. B. Preston found a single specimen at Patapolla, Ceylon, as recorded by Mr. E. R. Sykes (Proc. Malac. Soc. London, iii. 1898, p. 66), and Mr. O. Collett subsequently found two specimens at Hapatale (Sykes, *op. cit.* p. 160). The three specimens referred to agree with the figures in 'Conchologia Indica,' and it may therefore be safely assumed that they are correctly identified, and to Mr. Sykes belongs the credit of first pointing out the true systematic position of the species."

Mr. E. R. Sykes in his paper read June 1898, quoted above, after describing *Thysanota hispida*, a beautiful new species allied to *T. guerini*, records what he had worked out regarding *Helix biciliata*, Pfr.:—

"Practically all that we know of the *H. biciliata*, Pfr., is contained in his original description; there are also the figures by Hanley and Theobald. Pfeiffer records the habitat as 'Ceylon' and

refers to 'coll. Skinner.' As this collection passed into the hands of Miss Linter, I inquired if she possessed the species; she kindly informed me that no trace of it could be found in the catalogue of the collection. Recently I have had from Mr. Collett two very interesting specimens, in good condition, which I refer to this species. Provided we assume that when Pfeiffer speaks of 'carinis duabus' one may be almost in the suture, they agree fairly well with his diagnosis, save that on examining the base under a lens I find palatal and parietal armature of the *Plectopylis* (*Sykesia*) type. It may well be, however, that if his specimens were not in good condition this would not be apparent...... I think, therefore, that it is wiser to refer these shells to Pfeiffer's species, which must be regarded as a *Sykesia*, than to describe them as new."

It was in April 1897 that Mr. Gude, with his accumulated knowledge of the shells of *Plectopylis*, came to the conclusion it was necessary to form a subsection of the genus on two species "characterized by a thin and transparent shell with straight acute edges," viz. *clathratula* from Ceylon and *retifera* from India. In this he was, I consider, justified on shell-character, for these species are very distinct from typical *Plectopylis*; he writes:—"I propose the name *Austenia* in honour of Lt.-Colonel Godwin-Austen, who has contributed so largely to our knowledge of the genus." In May 1897, in 'Science Gossip,' vol. iii. p. 332, he amended this:—"Mr. E. R. Sykes and others have drawn my attention to the fact that the name *Austenia* proposed by me for a section of *Plectopylis* (*ante*, p. 300) is pre-occupied. Under these circumstances it is necessary to re-name the section, and I therefore propose the name *Sykesia*, in honour of Mr. Sykes, who was the first to point out this fact."

Mr. Gude, in his classification of the genus *Plectopylis*, 'Science Gossip,' vol. vi. Nov. 1899, p. 175, divides it into seven sections, the last of which is *Sykesia*. I give his key to the section:—

"VII. Section Sykesia.

A. *One* transverse parietal fold.
- *a.* Notched about the middle, a short support posteriorly above. Ceylon.
  - *α.* Umbilicus wide, ribs and lyræ prominent.. *clathratula.*
  - *β.* Umbilicus narrower, ribs and lyræ obsolete.. v. *compressa.*
- *b.* Not notched.
  - *α.* Straight, without support; umbilicus still narrower. Habitat India. *clathratuloides.*
  - *β.* Sinuous, with a short support anteriorly above: umbilicus still narrower ........ Habitat India. *retifera.*

B. *Two* transverse parietal plates.
- *a.* Shell flattened; no fold below umbilical angulation; umbilicus still narrower .......... Habitat Ceylon. *caliginosa.*
- *b.* Shell conoid, with a double fringe of curved hairs; a horizontal fold below umbilical angulation: umbilicus still narrower. Narrowest of all ........ Habitat Ceylon. *biciliata.*"

The type of the subgenus *Sykesia* is *clathratula*, Pfr., from Ceylon, and as the shell of this species is so very distinct in form from that of *T. guerini*, the type of *Thysanota*, I follow Gude and retain it. I certainly consider, however, that systematically (speaking from what its anatomy has shown me) it has the closest relationship with *Thysanota* and must be placed as a subsection of that genus in preference to that of *Plectopylis*, yet forming at the same time a natural link with this last genus.

The great distinctness as a group of the Southern Indian and Ceylon species of *Plectopylis* is pointed out by Mr. Gude. Dealing with the geographical distribution of the genus, he says ('Science Gossip,' vol. vi. Nov. 1899):—"A wide gap separates the Sikkim forms from the South Indian and Cingalese species, a fact which will be less surprising, if, as I suspect, the latter prove to belong to a distinct genus." Again, in the same periodical, vol. vi. p. 149, when writing on new sections of *Plectopylis*, he states:—"I strongly suspect that when the anatomy of the Philippine species (section *Enteroplax*) is investigated, the group will be found to differ so widely from typical *Plectopylis* that it will have to be raised to the rank of a separate genus. The same may prove to be the case with the section *Sykesia*."

Original description:—"*Testa perforata, convexo-lenticularis, tenuis, pellucida, cornea, oblique plicata, bicarinata; carinis pilis longis ciliatis; spira parum elevata, vertici subtili; anfr.* $4\frac{1}{2}$ *scalares, ultimus antice non descendens, basi vix convexus; apertura subobliqua, depresse securiformis; perist. simplex, rectum, marginibus subparallelis, columellari vix reflexiusculo.*

"Diam. major $7\frac{1}{2}$, min. $6\frac{1}{2}$, alt. $3\frac{1}{2}$ mill. (*Coll. Skinner*).

"Habitat in insula Ceylon."

Animal preserved in formalin. The whole foot was in extended state outside the shell. As these very small animals are white and pellucid, and, to a certain extent, contracted, it is by no means easy to make out what their form presents in a living state. The foot is long and narrow with a broad margin folded down the centre. No mucous pore could be detected. The shell-lobe borders and overlaps the peristome on the left side. There is a very pronounced shell-muscle. The tentacles are invaginated.

The jaw was distinctly seen in profile. I did not venture to meddle with it, for fear of losing it altogether and what was near it.

The radula (fig. 3 *b*) is similar to that of *Philalanka*:—

$$\frac{13 \;.\; 2 \;.\; 9 \;.\; 1 \;.\; 9 \;.\; 2 \;.\; 13}{25 \;.\; 1 \;.\; 25}$$

The middle tooth is on a narrow oblong plate, its point reaches halfway up, with very minute basal cusps.

The 1st admedian teeth are also on plates higher than their breadth and have one long tooth and one remote small side cusp. The 10th and 11th are transition teeth, having two short cusps on the outer side. The laterals commencing at the 12th tooth are on

oblong plates carrying two equal close-set conspicuous curved teeth springing from the inner upper margin of the plate and pointing diagonally inwards; on the outer side of these bifid teeth there is one minute little sharp tooth.

SYKESIA CLATHRATULOIDES.

*Locality.* Anamullay Hills (*Beddome*).

Gude, when describing this species in 'Science Gossip,' vol. iii. p. 332, May 1897, says, referring to *Sykesia clathratula*, that he believes the specimens referred to under that name by Mr. G. Nevill, in his 'Hand-list of Species in the Calcutta Museum,' as coming from Darjiling, to belong to this new form. Seven specimens are quoted as ex coll. F. Stoliczka. I am afraid there has been some mixing of specimens here. Stoliczka's collection was incorporated with the Museum Collection after his death, and this sort of mistake might very likely occur. I have never seen the species in undoubted Darjiling collections such as Dr. Blanford's and the large number I have myself. I do not think Stoliczka ever collected in Darjiling himself, so these shells must have been sent to him.

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Genus CORILLA, Adams.

(= *Atopa*, Albers.)

It is now necessary to show what degree of relationship is exhibited in the anatomy of *Sykesia* and its allies *Thysanota* and *Philalanka* compared with that of its associated genus *Corilla*, restricted to Ceylon, and how far the internal organs of this last agree with *Plectopylis* and its wide and distinctly separate distribution.

The ovo-viviparous habit of the animals of all these genera shows how intimate is their relationship.

CORILLA GUDEI, Sykes. (Plate CXIV. figs. 3–3 *g*.)

*Corilla gudei*, Sykes, Proc. Malac. Soc., July 1897, p. 234, pl. xvi. figs. 8–10 (shell).

The specimen I describe and figure was collected at Newara Eliya, Ceylon, and came among many other interesting things sent me by Mr. O. Collett. The foot (fig. 3) is short, white and smooth beneath, folded down the centre (fig. 3 *a*), no indication of a median area. Closely-set rectangular black patches give the upper surface a very dark colour; a pallial fringe is very noticeable. The membrane of the visceral sac is black for some distance behind the mantle-zone. The right dorsal lobe (fig. 3 *a*) is small, the left long, following the margin of the peristome, both pale-coloured; the mantle-margin is

mottled. Generative organs (fig. 3 *f*): the uterus was gravid and swollen, and while examining and turning the animal about in a watch-glass the transparent membrane broke, and out rolled a single very large oval egg, immature, granular, and with a dark nucleus. It measured 12 mm. on the major axis, 6½ mm. on the minor.

The buccal mass (fig. 3 *b*) is rather small and globose, its main muscles joining the shell-muscle are of great size and strength. The salivary gland is in one united, long, narrow mass lying some way back upon the intestine.

Jaw oxygnathic, curved (fig. 3 *e*).

The radula (fig. 3 *d*) was got out complete. Its formula is :—

$$\frac{18 \;.\; 18 \;.\; 1 \;.\; 18 \;.\; 18}{36 \;.\; 1 \;.\; 36}$$

The admedian and centre teeth all alike, narrow plates with a single tooth. The marginal have a more oblong plate and broad cutting-teeth sloping inwards. Semper gives a drawing of the 24th tooth, but at this distance from the middle line the characteristic oblong plates are not seen.

*Genitalia* (fig. 3 *f*). The penis is simple, bent on itself at the retractor muscle, which is short and attached to the wall of the branchial chamber; the vas deferens is very long and thick, tapering very gradually to where it joins the sperm-duct. The spermatheca is evidently very long, its thin walls were broken and mixed up with the uterus. It had evidently contained the spermatophore (*sp.ph.*); this consisted of a very long, thin, elongate tube somewhat flattened*. The oviduct and sperm-duct as usual, the first passing into an empty thin-walled duct, in which the embryonic shells are often present; the albumen-gland was large and elongate. There is nothing to indicate the presence of an amatorial organ.

It will thus be seen that the generative organs in *Corilla* are remarkably similar to those of *Plectopylis*: *vide* Ferdinand Stoliczka's memoir "Notes on Terrestrial Mollusca from the Neighbourhood of Moulmein (Tenasserim Provinces), with Descriptions of new Species," Journ. Asiat. Soc. Bengal, vol. xl. 1871, pp. 219–220, pl. xv. fig. 4. Another striking character common to both genera is found in the liver. Stoliczka says, p. 219: "The liver very extensive and of a peculiar, coarsely tubular, clustered appearance." In *Corilla* this

* If any doubt existed as to this being a spermatophore, and doubts do arise in the course of anatomical work on small species, it was set at rest by the form of the terminal end (fig. 3 *g*), which, minute as it is, has the form of the same part, *i. e.* the capsule, in such genera as *Austenia* (*vide* Plate XC. figs. 1 & 3). The genus *Corilla* presents us with another form of spermatophore. Extremely long and tube-like with no spines whatever. Their absence is very probably due to the drawn-out attenuate form of all internal organs packed very tight, and further constricted by the shell-barriers on the parietal and palatal sides, there would be no room for them, whereas in a large form (such as in *Girasia* and *Austenia*), which cannot withdraw itself into the shell at all, they reach their maximum development.

strikes the dissector at once; the clusters (fig. 3 *c*) are not unlike the fruit of the banana, to give an idea of their form, given off from a thin stem in paired groups of 4–6 each.

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Genus Plectopylis, Benson.

Ann. & Mag. Nat. Hist., 1860, vol. v. p. 244.

The generic relationship of *Plectopylis* has long been left for further investigation. In fact, ever since Ferdinand Stoliczka, thirty-six years ago*, described and figured the anatomy of the animals of two species, *P. achatina* (Gray) and *P. cyclaspis*, Bs., and gave his views thereon, very little more has been done from a morphological point of view. Conchologically, there is now little more to be done beyond the description of species which are yet to be found in the little-known parts of the countries east of Burmah and the Assam Valley. Some years ago I was led to point out the beautiful diversity of structure presented by the internal plication, and it was my good fortune to collect and describe several fine new forms †. This commencement left much still to be done, and I am glad to say it has since been taken up and carried to a high degree of excellence and completeness by the work, commencing with *Corilla* in 1896, of Mr. G. K. Gude, who, in a series of most interesting papers published in 'Science Gossip,' 1896–99, entitled "Armature of Helicoid Land-Shells," has shown the specific variation of every known species up to the present time. The greatest credit is due to work of this nature, for the interest surrounding this group of land-shells has been vastly increased. The animal now requires investigation, and I shall begin by extracting all the more important observations of Stoliczka. He commences by saying, on p. 217:—

"The anatomy of the animal of *Plectopylis* indicates a good generic distinction from allied forms. I cannot, however, say how far the peculiarities, to which I shall presently refer, agree with the Ceylonese *Corilla*, but a comparison of the two will no doubt prove interesting and establish more firmly the relations of the present genus to *Corilla*, *Ophiogyra*, and the American *Polygyra*. . . . . I fully expect that when the animal of *Helix retifera* becomes known, it will probably exhibit somewhat different characters from those of the present genus. . . . . I consider these internal folds to be in some respect analogous to the clausilium in *Clausilia*, the animals of the two genera being also somewhat similar in external characters. When the animal of *Plectopylis* retracts into its shell,

* Journ. Asiat. Soc. Beng. vol. xl. pt. 2, p. 217, pl. xv. figs. 1–6 (1871).

† "Descriptions of five new Species of Helicidæ of the Subgenus *Plectopylis*, with Remarks on all the other known Forms," P. Z. S., Nov. 1874, p. 108, pls. lxxiii. & lxxiv.

the passage through the folds is generally found to be filled up with mucous secretion, but the body itself mostly retracts one-half of a whorl further inwards. During hybernation the aperture is besides closed with the usual lamina as in other Helicidæ. I have examined the animals of *Pl. achatina*, *cyclaspis*, *pinacis*, and *macromphalus*. They are all very similar in external shape and organization. I will for the present note only the two first-named species, which occur near Moulmein."

After describing the external appearance of the animal in detail he continues, on p. 219:—

"On the whole, the form of the body very closely resembles that of a *Clausilia*, and a comparison of the internal organization of the two genera also indicates their close relation."

Then follows the description of the internal organs, which I shall not give here. On p. 220 is this interesting remark:—

"All the species which I have examined are ovo-viviparous, as already noticed by Benson in *P. achatina*. One specimen of *P. cyclaspis* had three well-developed embryos, each consisting of three convolutions, regularly coiled in and enclosed in a thin soft sac of calcareous granules, loosely jointed together. A specimen of *P. pinacis* had the whole uterus filled with 13 eggs, in different stages of development. The first were perfectly developed, composed of 2½ whorls, distinctly discernible. The youngest only consisted of a yolk-mass, darker internally than externally and folded on itself hemispherically like an enrolled *Oniscus*. The jaw is very thin, horny, semielliptical, with a small anterior median projection; it is marked transversely with a great number of more or less distant grooves which divaricate in the centre. The surface often besides shows in a transparent light a very fine concentric striation, either on the entire jaw or only on its median portion."

We then have a full description of the radula, still on p. 220:—

"On comparing the jaw of *Plectopylis* with that of *Clausilia* it will be seen that both are similar in structure, but the shape is different and the transverse sulcations are only indicated in the latter genus. Much greater is the similarity of the *Plectopylis* jaw with that of *Cylindrella* as published by Crosse & Fischer in Journ. de Conch. vol. x. 1870, p. 5 &c. pls. iii. & iv., with the exception that the median projection is wanting in the *Cylindrella* jaw.

"The arrangement of the teeth of *P. achatina* and *cyclaspis* also agrees with that of *Cylindrella* in the very small size of the centre tooth, but this is not a constant character. In *P. pinacis* the centre tooth is larger and more of a shape similar to that of the lateral teeth, which, however, in all the species retain distinctly the helicoid character."

Considering the uncertain variable utility of the generic divisions of the Terrestrial Mollusca and at the same time how far back in time some of these genera existed, I cannot imagine there is any very close relationship between *Corilla*, *Plectopylis*, and *Clausilia*, or that there is much that can be termed analogous in the clausilium of the latter with the internal pyloric plication of the two former.

while external characters taken in a wide sense apply to a multitude of very different genera. The relationship of *Plectopylis* and *Corilla* with *Ophiogyra*, *Polygyra*, and *Gonostoma* (North and South America) is, in my opinion, so remote as to be not worth further consideration. The odontognathous jaw of these last is sufficient to show this, to say nothing of other equally important differences. *Clausilia* can be traced back to the Eocene, but geological evidence points to the great probability of *Corilla* having been an inhabitant of Southern India in the Middle and Upper Cretaceous Periods.

*Anchistoma cretaceum*, Stol. (a fairly common species), *A. arrialoorensis*, Stol., and *A. arcotense*, Stol. (only a single specimen of these two last), are extremely like *Corilla* and *Plectopylis*, particularly the last-named species, with its closely many-whorled and flattened upperside (*vide* pl. i., 'Memoirs Geol. Survey of India: Palæontologia Indica,' "Cretaceous Rocks of Southern India," by Ferdinand Stoliczka). The similarity is enhanced by the presence of internal teeth and thin fold-like plaits; if a large series of specimens could be obtained, closer examination of the internal barriers would yield valuable results. Stoliczka says (p. 7):—"It can scarcely be doubted that a careful search in these deposits (Arialúr Group) formed in shallow waters (Mem. Geol. Surv. India, vol. iv. pt. 1, p. 163) would largely reward the observer by adding to the number of the Cretaceous land—and probably freshwater—shells also."

When Stoliczka wrote this (1867) he had not entered on the study of the anatomy of the Indian land-shells; he followed the classification of H. & A. Adams and Benson, and placed these fossil forms in *Anchistoma*; but he makes it quite clear, on p. 9, that they were in general form next to the Indian *Plectopylis*, which, in Adams' 'Genera of Recent Mollusca,' is included with some subgenera in the subgenus *Corilla*, H. & A. Adams, = *Atopa*, Albers, of the genus *Anchistoma*, Klein. Stoliczka also observed at this date how undefined the above subgenera are; he says (p. 9):—"To make these separations of real classificatory value, it is absolutely necessary that they be based upon the examination of the animals as well as the shells, so as to be certain whether the respective organs can in any way be depended upon as to their constancy." A work he commenced, did some admirable work in, but unfortunately was not spared to complete.

Plectopylis pinacis, Benson. (Plate CXIV. figs. 2–2 *d.*)

*Helix pinacis*, A. M. N. H. ser. 3, 1859, vol. iii. p. 268; Pfr. Mon. Hel. vol. v. p. 417; Hanley, Conch. Ind. p. 7, pl. xiii. fig. 5, p. 36, pl. lxxxiv. figs. 1–4.

*Plectopylis pinacis*, Theob. Suppl. Cat. p. 25; Nevill, Hand-list, i. p. 71; Godwin-Austen, P. Z. S. 1874, p. 612, pl. lxxiv. fig. 1 (parietal, vertical lamina of); Gude, Sci. Gossip, 1897, vol. iii. p. 206 (armature).

*Helix (Corilla) pettos*, Von Martens, Malakoz. Blätt. vol. xv. 1868, p. 158.

Original description :—"*Testa sinistrorsa, late umbilicata, orbiculato-depressa, superne oblique scabre plicato-striata, liris confertis spiralibus, subtus striis obliquis flexuosis striisque spiralibus decussata, cornea, epidermide fusca, scabra (junioris ad carinam præsertim hispida) induta ; spira planata, vix elevatiuscula, apice planato, sutura leviter impressa ; anfractibus* $7\frac{1}{2}$ *planulatis, lente et arcte accrescentibus, ultimo antice breviter descendente, superne subcarinato, subtus valde convexo, circa umbilicum profundum, perspectivum, conicum, compressiusculo ; apertura valde obliqua, lunari, peristomate expansiusculo, reflexo, albido, marginibus callo brevi, laminari, elevatiusculo, sinuato junctis.*

"Diam. major 14, minor $12\frac{1}{2}$, axis $4\frac{1}{2}$ mill.

"Habitat raro in regione Sikkim in valle Rungun [Rungnu] (4000 ped.), necnon prope Pankabari (1000 ped. alt.).

"Nearly allied to *H. plectostoma*, B., and inhabiting a tract in the vicinity of Darjiling in company with that shell. Much larger than the largest Khasia variety of this species, it is distinguished by its much wider conical umbilicus, its depressed planulate spire, planate whorls, closer and more conspicuous spiral striæ on the under side, and by the compression of the base round the umbilicus.

"As is the case in the Khasia Hills, there are two varieties of *H. plectostoma* in size ; but the largest of the Darjiling specimens does not equal in volume the small Khasia one which formed the type of my original description. Fresh Khasia specimens are furnished with a scabrous hispid epidermis, as well as the Darjiling varieties."

*Locality of specimen dissected.* Damsang. It also occurred on Rissom Peak, and apparently is not a rare shell.

*Generative organs.* The penis (Plate CXIV. fig. 2*a*) is simple, like that of *Corilla*, but very short in comparison with the great length of the rest of the genitalia and other organs occupying the closely-wound many-whorled shell. The vagina soon develops into the thin-walled oviduct, which was found occupied by about a dozen embryonic shells (fig. 2*b*) in various stages of development, the anterior ones, very well grown, showed the coiled visceral sac, and were covered with minute calcareous granules. The spermatheca was a thin cord with a sac-like expansion at the free end. The hermaphrodite-duct (fig. 2*b*) was long, convolute, and lying attached to the side of the albumen-gland.

The intestine (fig. 2*b*) was long and cord-like, the salivary glands small and elongate. The heart (fig. 2) is situated one whole whorl behind the aperture, and lies below the oval-shaped kidney. The oviduct is packed close to the heart.

The jaw (fig. 2*c*) is very thin and delicate, composed of 24 elongate plates which slightly overlap ; the central plates are the largest. These plates are attached to a mass of muscular tissue, or, in other words, this muscular tissue merges into the more solid plates ; in this respect there is a similarity to the jaw of *Succinea* ;

in the jaw of *Thysanota guerini* (fig. 4) the resemblance is still greater.

The teeth of the radula (fig. 2 *d*) are thus disposed :—

12 . 9 . 1 . 9 . 12 or 21 . 1 . 21.

The centre tooth is small, on a narrow oblong plate; the plates of the admedian teeth are nearly square, and there is an indication of a duplication followed by fusing of parts, for the square plate is divided into a long inner oblong portion and a shorter outer oblong portion having a well-defined rounded upper outer angle.

At the 10th tooth the very long inner cusp of the 9th tooth becomes bicuspid into blunt rounded points, the bicuspid form with a single small cusp outside it continues to the outermost teeth (*vide* the 19th). This type of radula, I may here note, is peculiar to the genera *Thysanota*, *Sykesia*, and *Philalanka*, to a greater or less extent with modification of the central and admedian teeth.

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## Subfamily Durgellinæ.

### Genus Durgella.

(*Continued from* Vol. II. p. 70.)

Durgella rogersi, n. sp. (Plate CXV. figs. 4, 4 *a*; Plate CXVI. figs. 7, 7 *a*.)

*Locality*. Paphunta Valley, South Andamans (*G. Rogers, Esq.*, 1906). B. M. Collection.

Shell globose, very thin, membranaceous : it was impossible to remove the animal preserved in spirit without tearing it. Whorls $3\frac{1}{2}$, colour pale straw, apex flatly rounded.

*Animal* about 20 mm., contracted in spirit. Foot long behind, pointed, keeled, narrow; sole divided; peripodial grooves with parallel streaking running from them to the margin of the foot. A fairly large rounded right shell-lobe rising on the side of the right dorsal lobe ; the left shell-lobe smaller than the right, rounded on the margin ; both shell-lobes somewhat thickened, pale-coloured, unmarked, and smooth.

The genitalia were not, unfortunately, got out in a state for description. The penis is simple, like that of *D. levicula* ; no amatorial organ seen.

Jaw very thin, almost straight in front, only a slight convexity in the middle.

Radula consists of an enormous number of teeth ; there are at least 500 in the row, and 70 rows can be counted. It was got out in nearly a perfect state, but the filmy edges got folded under it ;

and it is most difficult when this occurs to spread them out again, rendering counting impossible. The teeth are more numerous in this radula and more minute than in any I have seen hitherto; they are in form of similar type to those of *Durgella levicula* and *mairangensis*, of Tenasserim and the Khasi Hills respectively, but still closer to the outermost teeth of *Lamprocystis sumbaensis*, G.-A. (*vide* Vol. II., Plate LXXIX. fig. 8 *b*), which points to this last genus having a position rather with the subfamily Durgellinæ than any other.

The Sarasins give figures of the teeth of *Lamprocystis matinangensis* and *macassarica*: the outermost teeth are serrate below the terminal cusps; this is also the case in *Helicarion idæ*, Pfr., *celebensis*, Pfr., *adolphi*, Böttg., and *minahassæ*, Kob. In the shells of these two sets the only difference is in regard to the number of whorls, the shells of the first *Lamprocystis* being small and closer wound.

This interesting species of *Durgella* occurred among a small but very well preserved collection of land-shells made and sent home to the Natural History Museum by Dr. G. Rogers, after whom I have the pleasure of naming it. I have also to thank Mr. Edgar Smith for kindly letting me examine some of the valuable material.

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In connection with the position assigned to some Japanese land-shells in *Macrochlamys*, a genus which occupies so many pages of this work, and having considerable doubt as to this genus, strictly defined by internal anatomy, extending to this part of the world, I asked Mr. Hirase, of Tokio, to send me some examples preserved in spirit. He very kindly responded to my request, and the result has been exceedingly interesting as regards not only one but two genera.

The three specimens I received were from South Formosa, labelled respectively *Macrochlamys formosana* var. *hypografta*, Pilsbry & Hirase, *M. fulgens*, Gude, and *Helicarion hiraseanus*, Pilsbry. The last is, as I shall show further on, so intimately connected with an Assam species, that in spite of Formosa being so far outside the original scope of this work, I feel it is necessary to describe and figure all three in this Part.

The record of species confined strictly to some particular State or States has a certain amount of interest, and is useful to collectors, but the exact range of genera, so far as they can be traced, is of far greater importance and of absorbing interest; and in this connection it is impossible not to stray occasionally far beyond the limits of British India.

Subgenus Leptodontarion, P. & F. Sarasin, of Helicarion.

Type: *albacuminatus*, P. & F. Sarasin, Die Landmoll. v. Celebes, pp. 124, 125 (1899): shell, pl. xvii. figs. 148, 148 *a*; radula, pl. xxviii. fig. 280.

Second species: *coriaceus*, P. & F. Sarasin: radula, pl. xxviii. fig. 281.

The brothers Sarasin, in the above fine work, created this subgenus of *Helicarion*, based on the great number of teeth in the row and the similarity of the teeth throughout.

A striking resemblance is found between these species inhabiting Celebes and my *Durgella minuta* from the Dafla Hills (Vol. I., Pl. XXXIX. figs. 1–6), and the Sarasins notice this on p. 118.

Their description of the animal corresponds. The right shell-lobe broad and broadly oval; the left also broad, but towards the back part narrowing out; the foot truncate, with a little horn. The radula is precisely the same in both forms under comparison, and although the Sarasins do not give the number of teeth in the row, yet their general description of the radula exactly describes the *Durgella* type and how entirely different it is to other species included in *Helicarion*. The middle tooth is small, only a single point almost rudimentary; the side teeth are narrow, close together, bicuspid; the teeth stand in very long uneven lines. One may describe the radula as composed of the lateral teeth alone, the outside or marginals being absent.

They quote Semper on *Helicarion*, as pointing out that in the differences in the jaw, in the radula, and in the generative organs the shell does not go with them; and this is the case with the shells of *Helicarion* and *Leptodontarion*. They place *H. incertus* in it, but consider *H. tigrinus* doubtful. I include *Durgella hosei*, G.-A., from Borneo also.

Far removed from other forms of *Helicarion*, *Leptodontarion* is an excellent, well-defined subgenus, and together with *Durgella* (typical) I have placed it in the subfamily Durgellinæ (Vol. I. p. 253 and Vol. II. p. 60).

This peculiar type of radula—its minute teeth may be counted by hundreds in the row in some species—is almost as broad as it is long, very different to the ribbon-like form. It follows that the buccal mass is short, globose in shape, and rounded at the back, presenting a marked departure from the same parts in other genera of the Zonitidæ. With this radula is associated a very thin membranaceous jaw, also very different from the usual solid oxygnathous jaw of the same family.

Blanford considered that the Southern Indian *Durgella dekhanensis*, G.-A., and *D. levidensis*, together with *D. christianæ*, should form another genus.

Leptodontarion hiraseanus, Pilsbry. (Plate CXV. figs. 1–1 *b*; Plate CXVI. figs. 4–4 *d*.)

*Helicarion hiraseanus*, Pilsb. Proc. Nat. Sci. Philad. 1905, p. 740.

*Animal* (figs. 1 & 1 *a*) with a long foot, keeled, a narrow band of black running down it; mucous gland linear; neck to eye-tentacles black, the rest of body pale-coloured. Foot divided on sole; peripodial grooves as usual. Right shell-lobe broad, reaching to apex of shell, smooth; left shell-lobe moderately broad, tongue-like, narrowing to a point, also smooth and pale-coloured. The right dorsal lobe slightly papillate, the left long and narrow, divided by a slit into two. Visceral sac slightly spotted with black, and the kidney has a narrow black margin on the right side.

*Genitalia* (fig. 4). The penis (fig. 4 *b*) is a simple tube, with a rather long retractor muscle at the usual bend, the epiphallus moderately long and slightly swollen. The most interesting organ is the spermatheca (figs. 4 & 4 *a*), which is stalk-like below, terminating in a spherical sac. The oviduct was of great size in the specimen examined, being a gelatinous mass; the albumen-gland (*Al.gd.*) also unusually large, compared with the penis and other organs.

The jaw (fig. 4 *d*) is thin and delicate in structure, with a slightly curved cutting-edge.

The radula (fig. 4 *c*) is a most delicate broad band, consisting of certainly nearly 450, perhaps more, teeth in the row—a series all alike, narrow, curved, and nearly evenly bicuspid, the central unicuspid. The series of teeth narrow gradually from centre to margin; three or four of the outermost teeth on very edge of the radula are serrated. It is precisely like that of *Leptodontarion* figured by the brothers Sarasin in their work on Celebes, pl. xxviii. fig. 280. The whole of the radula was got out, but it is unfortunately so folded that I cannot count the teeth, and it was too brittle to attempt any arrangement of the torn parts. The centre teeth are well seen at one part.

*Original description*:—"Shell imperforate, depressed-globose, thin and fragile, pale amber-coloured, transparent. Surface very glossy, smooth and polished. Spire convex, narrow. Whorls $3\frac{1}{2}$, rapidly increasing, the last rounded peripherally and beneath. Aperture oblique, broadly lunate, the peristome with a narrow reflexed cuticular edge. Columella simple, thin, concave.

"Alt. 6, diam. 9·5 mm.

"Sammaipo, Taiwan. Types No. 90, 235, A. N. S. Phil., from No. 1431 of Mr. Hirase's collection.

"Six specimens of this charming species were taken. No snail of similar *Vitrina*-like shape is known from Formosa, the Ryukyu Islands, or Japan."

Subgenus Ibycus, Heynemann.

(*Continued from* Vol. I. p. 242.)

On further reference to Heynemann's drawing of the teeth of the radula I have come to the conclusion that *Ibycus fissidens*, Heyn., is a species allied to *Durgella minuta*, G.-A., from Assam, and therefore must be considered to belong to the family Durgellidæ, certainly as far as the radula is concerned; so with this radula as a guide, there is every probability that *I. fissidens* will turn up again in Sikkim, provided Schlagintweit's locality is correct. As so much of the single specimen Heynemann had to deal with was in a decayed state, it is advisable to await its rediscovery to see how far, besides the radula, it agrees with *D. minuta* of Assam, or even the Celebes species of *Leptodontarion* previously referred to.

The shell of *D. minuta* has 2½ whorls; the small anterior part figured of the shell of *I. fissidens* looks more like that of a spatulate form.

For the present the safest course is to retain *Ibycus* for the Indian *fissidens* type alone, leaving *Leptodontarion* for the Malayan *albacuminatus* and allied species.

I have now to unsay, and undo, much of what I wrote in 1888, on pp. 239–241 of Vol. I. At that time I laid too much stress on the *shell* of *I. fissidens*, or what remained of it, being spatulate, like that of *Girasia sikkimensis*, and I overlooked the figured radula. With this in mind, on p. 239 I made *Ibycus* a subgenus of *Girasia*, and in it included some five species:—

*Girasia sikkimensis*, G.-A. (Plate LIX. figs. 2, 2 *a*, animal; 2 *b*, shell.)

*G. sikkimensis*, var. *mainwaringi*, G.-A. (Plate LIX. figs. 3, 3 *a*, 3 *b*, animal.)

*G. cinerea*, G.-A. (Plate XL. fig. 8, animal from life.)

*G. cacharica*, G.-A. (Plate LIX. figs. 4–4 *b*, animal and shell; Plate LXII. figs. 5–5 *c*, radula and gen. org.)

*G. solida*, G.-A.

All these I now consider have no relationship with *Ibycus*, and must remain under *Girasia*.

Take the first, *G. sikkimensis*. Compared with *fissidens*, the radula, a far more important character than the shell, is like that of *Austenia gigas* (*vide* Vol. I. p. 239).

Mr. T. D. A. Cockerell has been led away by shell-character also: see a paper by him, "Notes on Slugs," Ann. & Mag. Nat. Hist. vol. vii. No. 37, Jan. 1891. In his main Division B ("Shell more or less whorled, but not truly Vitrinoid; whorl subrudimentary)"*,

* I cannot endorse the view that in shells of the *Helicarion* type a slight addition of half or one whole whorl (making it, conchologically speaking, "truly Vitrinoid") is sufficient reason for creating a new genus. A single conchological character is thus made of enormous weight, while all the truly important complicated internal organs of the animal are ignored. This applies equally to a rudimentary shell like *Girasia* and the intermediate forms passing into *Austenia* of the typical *gigas* shape.

he places *Ibycus* of Heynemann after *Austenia* (type *gigas*, Bs.), and includes in *Ibycus I. fissidens*, Heyn., the type, coupling it with *sikkimensis*, as if they were one and the same species. There is no authority to support this, and he went further than I had done when I wrongly placed *sikkimensis* in *Ibycus* as a subgenus of *Girasia*.

Stoliczka, when writing on *Sophina calias* (J. A. S. B. 1871, p. 256) and describing its progressive shell-growth makes some instructive remarks, which are as applicable to genera as they are to the individuals of a species, which, upon reaching a certain stage of maturity, rests, and then commences a further increase of the shell, thus altering its form materially. Thus it is possible that a genus A may have its origin in the young form, while another, B, starts from the more mature.

I have also to notice the description (external character only) of "*Ibycus sikkimensis* (G.-Aust.)=*fissidens*, Heyn.," p. 106, taken from a specimen in the British Mnseum without locality, "purchased at Stevens." The specimens may or may not be the same as *G. sikkimensis*, G.-A., type in my collection, with which it was not compared, and of which the greater part of the anatomy had been described, the radula proving to be absolutely different to that of *I. fissidens* (Vol. 1. pt. vi. p. 239) *.

I cannot accept Mr. Cockerell's conclusions, based on this specimen: *G. sikkimensis*, G.-A., stands, I consider, as a good species. Neither can I accept the views put forward at the end of the paragraph, which I give in full, especially regarding the generic position of a Javan species:—

"*Ibycus fissidens*, Heyn., was very insufficiently described; but as it agrees with *sikkimensis* in all known points and was from the same neighbourhood, though at a higher altitude, there seems no reason for regarding it as distinct. Heynemann's name has priority." A comparison of Heynemann's drawing of the radula and my description of that of *sikkimensis* was never made when this was written. Quoting further: "*Ibycus*, as a generic title, may perhaps be used for a large series of forms allied to *fissidens*, including *pupillaris* (Humb.) from Java. *Limax problematicus*, pl. viii. F. figs. 13–17, belongs to *Ibycus*, and seems allied to *sikkimensis*."

As to *Ibycus siamensis* (p. 107), this must be put in some other genus when the anatomy is examined. I have seen the specimens in the Natural History Museum, and came to the conclusion they had no affinities with *Africarion ater*. In the 'Proceedings of the Zoological Society of London,' April 1891, p. 225, "On the Geographical Distribution of Slugs," the same author states, commencing at the bottom of p. 224, what I consider cannot be supported on our meagre knowledge of *Ibycus fissidens*, viz. that "*Ibycus* occurs in the Himalayas, in Siam, and in Java; it also exists in Borneo if, as I believe, the *Parmarion baccarii* and *P. doriæ* of Issel (which are

* In truth, so little is known of *I. fissidens* beyond its radula that it is quite unsafe to place any species, certainly on external character, in Heynemann's genus.

probably two forms of the same species) are correctly referable to it. *Girasia* is specially characteristic of the Indian region *. *Mariaella*, a very distinct genus, has almost identical forms in S. India, Ceylon, and the Seychelles. *Parmacochlea* has a single species from the northern extremity of Queensland, but is represented in the Indian region by a subgenus *Pseudaustenia* (nov. nom.) of *Ibycus*, the type of which is the *Africarion ater* of Godwin-Austen."

As to *Mariaella* and its distribution, it has been very clearly shown since 1898, by Cockerell himself, that the habitat Mahé is the place of that name on the S.W. coast of India (Vol. I. p. 113), not Mahé of the Seychelles.

It would also have been better not to have selected, out of all the species of *Girasia*, *crocea* as the one having a resemblance to *Mariaella* in some of its characters; the type species, *G. hookeri*, would have been a better example for this purpose, because, as I have pointed out (Vol. II. p. 223), the radula of *G. crocea* differs very much from that of *G. hookeri*, whereas the latter is of the same type as in *Mariaella*. It is interesting to note that there is considerable similitude to be found in the teeth of *Ibycus fissidens* and *G. crocea*, the latter showing a decided approach to the Durgelline type.

*Pseudaustenia*, Cockerell, = *Africarion*, G.-A., is made a subgenus of *Ibycus*. This I cannot agree with; I would ask any worker at these forms to compare Heynemann's drawing of the radula of *Ibycus* with my drawing of the radula of *Africarion pallens* on Plate XLII. figs. 6–6 *b*, which is similar to that of *A. ater* (Vol. I. p. 244). Again, *Parmacochlea*, E. A. Smith, of Queensland, is said to be represented by *Pseudaustenia*, i.e. *Africarion ater*, G.-A., in India. There is a certain likeness in their shells, but I see important differences in the generative organs and radula which, to my mind, show these genera to be widely separable.

In several minor particulars my *Africarion ater* differs from the African species *pallens*. Cockerell's name *Pseudaustenia* will stand well for this South-African form, but it may be noted that the amatorial organ is absent in both species.

Starting with the view I hold—that the radula of *Ibycus fissidens* is very distinctive, in fact of the character found in the subfamily Durgellinæ, and therefore that Heynemann's *Ibycus* for the present certainly should apply to this species alone,—all those species placed after *Ibycus* in the 'Check-list of Slugs' must find a location in other genera, there being nothing to show that they are in any respect related to the type species. Among these is *Girasia magnifica* (Vol. I. p. 225), for which Mr. Cockerell has instituted the subgenus *Cryptibicus* ('The Nautilus,' 1898). This conveys not only the idea of similarity but of relationship, for which there is no support. The adoption of the subgenus becomes of doubtful necessity. I am sorry to thus disagree with another naturalist's conclusions.

* "The group of *G. crocea*, G.-A., although true *Girasia*, shows a resemblance to *Mariaella* in some of its characters. The species which I described as *Girasia depressa* I now consider to be a variety or subspecies of *G. crocea*."

I am not seeking for faults; for I know Mr. Cockerell's work lies parallel to my own—that we are both working with the same end in view.

With regard to disagreement on the question of classification, it has given me considerable pleasure to read the Appendix to the 'Check-list of Slugs,' written by Mr. Walter E. Collinge: there is so much valuable advice to be found therein. With Mr. Collinge I have had in the past agreements and disagreements, and these last I, for one, consider regrettable in a certain sense. But such must crop up in connection with the work we are interested in: agreement is impossible, when we consider the scanty material there has been in hand to work upon. Malacologists are, in fact, making a survey of a close, complicated, and difficult region; to use a Survey simile, we none of us start from the same measured base of thought, experience, or eyesight and material. It is to be hoped, when all errors are eliminated and apportioned, we and our successors in this field of exploration will close on a base-line as nearly equal as possible. The following lines by Mr. Collinge will not, I feel, be out of place (p. 55):—"This new system, which I am pleased to observe is spreading to other departments of zoology *, demands a knowledge of internal as well as external morphology, and, as I have previously stated †, *rightly refuses to recognise inadequate descriptions or descriptions of shells apart from the animal, or to acknowledge genera or species founded upon purely external features*; in short, it demands that they shall be classified and created 'upon the aggregate characters,' and not upon single features" ‡. P. 56:—"Recourse must therefore be made to the anatomy. In the form of the various organs we find a permanent and well-marked difference between one genus or species and another. . . ." I quite agree with the following paragraph:— "Until Mr. Cockerell describes and figures the anatomical differences in his species of Slugs, I cannot accept them as valid. I do not say that they are not so, as many seem to be very distinct, judging from the external features, &c.; but until I see structural differences, not mere variations in the breadth of colour of some single organ—differences which mark them off in the majority of individuals from their nearest known ally,—I shall regard them as doubtful."

PETALOCHLAMYS, subgen. nov.

Type, *formosana* var. *hypograpta*, Pils. & Hirase.

Shell many-whorled, depressedly conoid, *smooth, shining*. Animal with broad and elongate shell-lobes, quite separate one from the other, more or less veined. No amatorial organ (a common character in these Malayan and Australian forms). The marginal teeth bicuspid, not serrate.

*Range*. Formosa and New Britain.

* W. F. Kirby, 'Nature,' 1893, 10th August, p. 339.

† 'Conchologist,' 1892, vol. ii. p. 64, footnote.

‡ Hedley, Trans. New Zeal. Inst. 1892, vol. xxv. p. 158.

Petalochlamys formosana var. hypograpta, Pils. & Hirase. (Plate CXV. figs. 2–2 *b*; Plate CXVI. figs. 5–5 *b*.)

*Animal* (figs. 2, 2 *a*). Foot long, not keeled, dark-coloured towards the extremity, which is pointed, with a narrow linear mucous gland; the pedal margin pale, showing distinct from the foot above, finely streaked; the peripodial grooves close together, forming a narrow band; sole of foot with a central area. The visceral sac specked black in front.

The right shell-lobe broad, leaf-like, black with white venation running from two branches to the edge; the left shell-lobe broad, slightly narrowing, with three or four parallel white veins running from the edge of the mantle to the free end, throwing off minute veinlets *. The right dorsal lobe spotted with black, the anterior left dorsal lobe less so. The left dorsal lobe very small.

*The genitalia* (fig. 5). There is no amatorial organ. The penis is simple, the retractor muscle rising from the bend. The spermatheca was not seen in the first specimen dissected. The oviduct long.

The radula (fig. 5 *a*) has the formula

+24 . 2 . 13 . 1 . 13 . 2 . 24+

May be a few more laterals; no row was quite perfect to the very edge. The central tooth is tricuspid, also the admedian; the laterals are short, evenly bicuspid.

The jaw (fig. 5 *b*) has a strong central projection.

The buccal mass small, globose.

This species has been described by Mr. Hirase, of Tokio, as a *Macrochlamys*. A glance will show it has no affinity with that genus, nor has it with forms such as *Austenia*, although the shell is covered with broad lobes; the genitalia are on quite a different plan. The species nearest to it with which I am acquainted is *Helicarion? willeyana*, from New Britain, described by me in the Proceedings Malacol. Soc., April 1903, vol. v. p. 296, pl. ix. figs. 1–1 *e*. Every character is the same in both. In the above paper I point out how *Helicarion idæ* differs from *willeyana* in the radula and foot †.

* These shell-lobes are quite separate the one from the other, not united as in true *Helicarion helenæ* (*vide* Vol. I. Plate XLI. figs. 2–4).

† I extract what I wrote in the above paper on pp. 297 & 298:—

P. 297. "The interesting points in this species (*H. willeyana*) are the great length of the foot and the great expanse of the shell-lobes, with the conspicuous central vein. The Drs. Sarasin, in their work, 'Die Land-Mollusken von Celebes,' pl. xvii. fig. 149, show a somewhat similar veined structure in the large right shell-lobe of *Helicarion idæ*. The radula is of a different type, with multi-serrated marginals, and the foot of the animal is widely different in form from that of the present species; so I think it safe to say, this New Britain form has little relationship with that species."

P. 298. "In this species the following characters may be noted:—(1) the absence of the amatorial organ; (2) the simple form of the penis, with no kalk-sac or cæcum at the retractor muscle; (3) the very small number of teeth in each row of the radula—that is to say, the radula is very narrow as compared with that of some species of *Helicarion*. Thus far it agrees with *Helicarion permolle*, Stoliczka, from Penang, and as regards characters 1 and 2 with

This Formosan form differs, again, from the typical Australian *Helicarion helenæ*, as I have pointed out above, in the detached position of the shell-lobes. I consider, therefore, sufficient grounds exist for placing *formosana* var. *hypograpta* and *willeyana* in a new subgenus of the Helicarionidæ.

MACROCHLAMYS FORMOSANA, Schmacker & Boettger, Nachr. mal. Ges. 1891, p. 149, pl. i. figs. 2 *a*, 2 *b*.

Original description:—"*T. modica, anguste umbilicata, umbilico $\frac{1}{20}$ latitudinis testæ æquante, convexiusculo-depressa, tenera, valde nitens, pellucida, corneo-flavescens; spira vix exserta, convexiuscula; apex obtusus. Anfr.* 5–5½ *rapide accrescentes, sutura distincte appressa, disjuncti, applanati, leviter striatuli, parum distincte spiraliter lineolati, ultimus non descendens, plus quam duplo latior quam penultimus* $\frac{4}{5}$ *altitudinis testæ æquans. Apertura ampla obliqua, transverse ovalis, sat profunde excisa; peristoma simplex, marginibus regulariter curvatis, columellari ascendente, summa parte protracto et triangulariter dilatato, umbilicum parum obtegente.*

"Diam. maj. 14½–15½, min. 12½–13, alt. 7–7½ mm.; alt. apert. 6½–7, lat. apert. 8–9 mm.

"*Hab.* Süd Cap von Formosa, am Füsse des Berge, lebend gesammelt."

LAMPROCYSTIS? FULGIDA, n. sp. (Plate CXV. figs. 3–3 *f*; Plate CXVI. figs. 6, 6 *a*.)

*Locality.* South Formosa (*Hirase*).

Shell scarcely perforate, depressedly globose, shining; sculpture very regularly striate longitudinally, striæ fine, wide apart on a smooth surface; colour pale horny, with a green tinge; spire subconic, rounded at the apex, sides flat; suture rather shallow, adpressed; whorls 4½, increasing regularly; aperture broadly lunate, almost an arc of a circle on the outer margin; peristome thin; columellar margin vertical, no reflexion.

Size: major diam. 9·75, alt. axis 4·0 mm.

This shell was sent to me by Mr. Hirase as *Macrochlamys fulgens*, Gude. In order to be sure of the identification, I have been favoured by Mr. Gude with the loan of his type specimen, and have made a figure of it on same scale (Plate CXVII. fig. 8). It differs very materially in form, the last and antepenultimate whorls being far more globose and tumid; and I think I am safe in separating the Formosan species from that of the Lu-chu Islands.

Animal (figs. 3 *a*, 3 *b*) very dark brown. Foot very long, narrow,

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*H. kukenthali* and *H. halmahericus*, Kobelt, from the Celebes. But in these two last the type of radula is quite different; they have 320 and 602 teeth respectively in the row, as against only 95 in *H. willeyana*. It does not agree with *Lamprocystis*, as typified by *L. succinea*, for in this genus Pfeiffer places several ovo-viviparous species, and we find this last character common to *Microcystis* and *Fretum*, Sykes (= *Eurypus*, Semper). It finds no place in Semper's group with chitinous papillate structure in the penis—his 'Reizpapillen' (= *Pseudhelicarion* of von Möllendorff: type *Helix ceratodes*, Pfr.)."

keeled, pointed at the extremity; mucous gland narrow, linear; peripodial grooves strongly marked above a broad distantly fringed margin. Sole of foot (fig. 3 *c*) with a central area.

The shell-lobes large and separate; the right (fig. 3 *d*) spreading from a thickened part near and above the respiratory orifice, black in the centre, with a single central vein throwing out a few veinlets; the left (fig. 3 *a*) is only spotted with black. Anterior and posterior left dorsal lobes; the last very small and distant from the former.

The generative organs are very small and difficult to get out entire: the penis was seen, of the type of *formosana*; a very long oviduct.

The jaw (Plate CXVI. fig. 6 *a*) is nearly straight in front, thin and feeble.

Formula of radula (fig. 6):—

$$65 \;.\; 2 \;.\; 10 \;.\; 1 \;.\; 10 \;.\; 2 \;.\; 65$$
$$77 \;.\; 1 \;.\; 77$$

The above description of the animal of the Formosan species *fulgida* shows there is no relationship whatever to *Macrochlamys*, but that it belongs to a very distinct group of the Zonitidæ. It is most difficult to assign to it a satisfactory generic position. In *fulgida* there is a considerable departure from *P. formosana* var. *hypograpta* and *P. willeyana*, although all three have a broad right shell-lobe, with central vein-like markings. In the radula of *fulgida* the lateral teeth are far more numerous and pectinate, like those of *Durgella*: in this respect they recall the radula of *Durgella? sumbaensis*, from the Dongo Mountains (*vide* 'Land & Freshw. Moll. India,' vol. ii. p. 66, Plate LXXIX. figs. 6–8 *b*); and I pointed out (p. 67) how this radula differed from that of true *Durgella* as represented by that of *Durgella levicula* &c. According to the Sarasins, species with this form of radula find a place in *Lamprocystis*. In their 'Mollusca of Celebes,' p. 129, the so-called *Macrochlamys minuta* of v. Martens is referred to this genus; and they refer to Wiegmann's excellent figures, which show that the radula of *minuta* is quite like that of *fulgida*.

It is probable that *M. fulgens* of Gude, from the Lu-chu Islands, is very closely allied to *Lamprocystis fulgida*, and must for the present be placed in this last-named genus. In order to show more clearly the differences between the two shells, I give here Mr. Gude's description of *M. fulgens*; and I may say his figures of it (pl. viii. figs. 24, 25, & 26), although small, are exceedingly accurate.

Macrochlamys fulgens, Gude, Proc. Malacol. Soc. Lond. vol. iv. no. 2, p. 75, pl. viii. figs. 24–26. (Plate CXVII. fig. 8.)

Original description of *Macrochlamys fulgens*, Gude:—

"Shell perforate, trochoid, thin, shining, pellucid, dark corneous. Spire depressed, apex obtuse, suture linear, margined. Whorls 4, increasing rather suddenly; the last twice as wide as the penulti-

mate, convex, a little inflated; finely striated, decussated by microscopic spiral lines. Last whorl not descending, slightly excavated in the umbilical region. Aperture slightly oblique, lunate; peristome thin, straight, acute; margins distant, subparallel, the columellar margin a little reflected and nearly covering the very narrow umbilical perforation.

"Diam. maj. 7, min. 6 mm.; alt. 4·5 mm.

"*Hab.* Lu-chu Islands.

"Type in my collection. Ten specimens.

"This *Macrochlamys* is, I believe, the first recorded from the Lu-chu Group."

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The animal of *Helix macropleuris* has never been described; it has been placed in *Kaliella* by Theobald, in *Microcystis?* by Geoffrey Nevill, in *Thysanota* by Clessin. It may possibly belong to the Thysanotinæ, but certainly not to the two first-named genera.

The shell is so distinctive, I think it desirable to create a genus for its reception. This I name *Rahula* ("a son of Buddha"), and include in it the species *H. bascauda*, Bs.; also *H. polypleuris*, W. T. Blf., from Arakan, a species very close to *bascauda* of the Khasi Hills.

### Genus Rahula, nov.

Type *H. macropleuris*, Bs.

Shell elongately pyramidal or conically trochiform; basal side flat, deeply umbilicated, subangulate around the umbilicus; apex pointed or rounded; costulation strong, close or distant, more or less absent on the apical whorls. Whorls 6–8, more or less carinate on the keel of the last.

Rahula macropleuris, Benson. (Plate CIII. fig. 1.)

*Helix macropleuris*, Bs. A. M. N. H. 1859, ser. 3, vol. iii. p. 265; Pfr. Mon. Hel. vol. v. p. 183; Hanley, Conch. Ind. p. 37, pl. lxxxvii. fig. 10.

*Kaliella* (sec. B) *macropleuris*, Theob. Suppl. Cat. p. 20.

*Nanina* (*Microcystis?*) *macropleuris*, Nevill, Hand-list, i. p. 42.

*Thysanota macropleuris*, Clessin, Nomen. Helic. p. 82.

*Helix macropleuris*, Pfr. Mal. Blätt. 1859, p. 24. no. 700 *a*.

*Hab.* Rissom Peak, 6410 ft.

Shell figured.

Major diam. 3·75, alt. 4·75–5·8 mm.

Original description:—"*Testa subaperte umbilicata, attenuato-pyramidata, oblique minute arcuato-striata, superne costis remotis elevatis arcuatis munita, decorticata, albida, nitidula; spira pyramidali, superne attenuata, apice papillari, papilla laviori, sutura carinato-marginata; anfractibus 8 convexiusculis, ultimo non descendente, filoso-carinato, subtus planulato, versus aperturam*

*convexiusculo, circa umbilicum profundissimum, anguste perspectivum, angulato; apertura obliqua?, transversa, quadrata, peristomate tenui, recto, margine columellari lato, expansiusculo.*

"Diam. major 5, minor $4\frac{1}{2}$, long. $5\frac{1}{2}$ mill.

"Habitat in valle Rungun [Rungnu], prope Darjiling, rarissime.

"This shell is an exaggeration of the *bascauda* type of the Khasia Hills, with a more remote costulation and lengthened attenuate spire. The aperture of the single dead specimen collected by Mr. W. T. Blanford is not in the best condition."

Several specimens of this pretty species occur among the shells collected by Mr. W. Robert in the hills east of the Teesta River, also an allied form from Damsang.

Benson described a species as allied to *macropleuris*, viz. *H. corys*. This single dead specimen I find is in the Blanford Collection, which he presented by will to the Natural History Museum. The specimen has suffered much since Benson described it, and it is now only 2 mm. in length; the aperture and last whorls gone. I give a drawing of

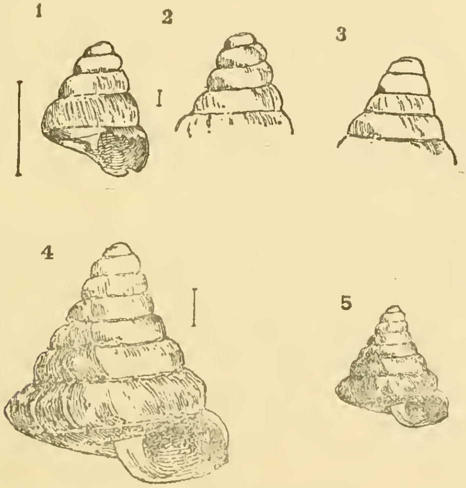

Fig. 1.—*R. corys*, Bs. Type. Young shell, × 9.
2.—Apex of specimen No. 34, Blanford's Collection, named *macropleuris*, × 9.
3.—Apex of *R. macropleuris*, Bs., × 9.
4.—*R. corys*, Bs., Damsang, × 6.
5.—Ditto, ditto, × 3.

this (fig. 1); also one of the apex of a true *macropleuris* and the Damsang specimen—the three enlarged to the same amount. I cannot see any appreciable difference between the apex of *corys* (fig. 1) and the third specimen* (fig. 2). The suture is marginate near the apex; the costulation at remote intervals does not begin

* No. 34 of Blanford's catalogue of shells on glass slips.

until the fourth or fifth whorl. I refer this form to Benson's *H. corys*.

The apex of typical *macropleuris* (fig. 3, p. 217), it will be seen, is distinctly filose at the suture, even at the third whorl; and the side of the spire is flatter, very different to figs. 1 & 2.

The shell from Damsang (figs. 4 & 5), which I consider *corys*, differs considerably in other characters from *macropleuris*. In this last the spire is pyramidal, with flat sides, as in Plate CIII. fig. 1; in *corys* (figs. 4 & 5, p. 217) the spire contracts more rapidly above the antepenultimate whorl, and the sides are decidedly concave. The distant costulation is stronger; the base is flatter; the columellar margin broader; the aperture is quadrate and smaller; while the umbilicus is also smaller (*vide* Benson's description, below).

Rahula corys, Benson. (Fig. 1, p. 217, type, × 9.)

*Helix corys*, Benson, A. M. N. H. 1859, vol. iii. p. 265.

*Kaliella* (sec. B) *corys*, Theobald, Suppl. Cat. p. 20.

*Thysanota corys*, Clessin, Nomen. Helic. p. 82.

Original description:—"*Testa perforata, elongato-pyramidali, oblique confertim minutissime costulato-striata, albida, non nitente; spira anguste pyramidali, apice obtusiusculo, sutura impressa; anfractibus 5½ convexiusculis, ultimo ad peripheriam filoso-carinato, basi planiuscula; apertura obliqua?, quadrata, longitudine latitudinem æquante, peristomate tenui, recto, margine columellari verticali, longe vix expansiusculo.*

"Diam. 2, long. 3 mill.

"Habitat in valle Rungun [Rungnu], prope Darjiling, rarissime occurrens.

"A single dead specimen occurred to Mr. W. T. Blanford. This minute shell is of a type allied to the last-described species in form, but is very differently sculptured. Its more pointed, not papillate apex, and the absence of costulation at somewhat remote intervals, and of a marginate suture, through so many whorls, prove that it is not the young of *macropleuris*. From the clear horn-coloured *Helix fastigiata*, Hutton, of the Western Himalaya, it may be known by its narrower spire, decided sculpture, minute size, the absence of a marginate suture, and by its perforate base; and from the dark-coloured *H. barrackporensis*, Pfr., of the Sikkim Terai, by the first three characters."

Rahula bascauda, Benson. (Plate CXVII. figs. 1, 1 *a*, 3, 3 *a*.)

*Nanina polypleuris*, W. Blf. Journ. A. S. B. 1865 (Arakan Hills), p. 76.

*Helix bascauda*, Bs. A. M. N. H. 1859, ser. 3, vol. iii. p. 186; Pfr. Mon. Hel. vol. v. p. 256.

*Helix bascauda*, Hanley, Conch. Ind. p. 8, pl. xvi. fig. 1.

*Kaliella* (sec. B) ——, Theob. Suppl. Cat. p. 20.

*Nanina* (?) —— (? = *Nanina polypleuris*, Blanford), Nevill,

Hand-list, i. p. 42; recorded from Darjiling, Jaintia and Naga Hills, Dafla Hills, Arakan, and Pegu.

*Patula* (sec. 2. *Patulastra**) *bascauda*, Clessin, Nomen. Helic. 1881, p. 90; Pfr. Mon. Hel. vol. v. p. 136.

Original description :—" *Testa anguste et profunde umbilicata, conica, trochiformis, costis elevatis remotiusculis obliquis, subtus flexuosis, regularibus ornata, rufo-cornea ; spira conica, apice obtusiusculo, sutura impressa ; anfractibus* 6 *convexiusculis, ultimo non descendente, ad peripheriam filoso-carinato, subtus convexo, circa umbilicum subangulato ; apertura quadrata, peristomate tenui, acuto, margine columellari, necnon basali, parum expansiusculo.*

" Diam. major $4\frac{1}{2}$, minor 4, axis 4 mill.

" Habitat ad Teria Ghát, montium Khasiæ.

" A pretty little species, distinct in character from any Indian shell yet published, and remarkable for the frequent strong and regular ribs, and for its thread-like carination."

RAHULA POLYPLEURIS, W. T. Blf. (Plate CXVII. fig. 2.)

*Helix polypleuris*, W. Blf. J. A. S. B. 1865, p. 76.

*Xerophila* (section *Turricula* †) *polypleuris*, Blf., Clessin, Nomen. Helic. 1881, p. 133.

*Original description* :—" Shell openly umbilicated, trochiform, rather solid, white (probably horny in living specimens), obliquely and closely costulated. Spire conoid, apex rather obtuse; suture impressed. Whorls 6, convex, slowly increasing; the last not descending, surrounded by a raised thread-like keel, convex beneath and sometimes somewhat sinuously radiately costulated around the deep and pervious umbilicus. Aperture oblique, roundly lunate, almost circular ; peristome thin; margins distant, columellar slightly expanded.

" Major diam. 4, minor $3\frac{3}{4}$, axis 3 mm.

" *Habitat.* Arakan hills ; rare.

" A prettily marked little species near *H. bascauda*, Bs., from which it is distinguished by its finer and closer sculpture, more open umbilicus, and less conical spire. It is very probably a *Nanina*, but the animal was not met with."

RAHULA BASCAUDŪLA, n. sp. (Plate CXVII. fig. 7.)

*Locality.* Risett chu and Richila Peak, Daling District.

Shell very openly umbilicated, trochiform, flat on base, sharply keeled, with fine carination ; sculpture very close fine costulation, oblique ; colour chestnut-brown ; spire conoid, apex rather blunt, sides very slightly convex ; suture impressed. Whorls 6 ; aperture quadrate ; peristome thin, angulate on lower outer margin ; columellar margin subvertical.

* *Patulastra*, a genus with a very mixed collection of shells from many parts of the world.

† *Turricula*, Beck, type *caroni*, Desh., = *Carocolla turrita*, Phil., H. Beck, Ind. Moll. p. 10 : a Sicilian shell.

Size: major diam. 4·50, alt. axis 3·0 mm.

This shell is very close to that of *R. bascauda*; but placed side by side these differences are to be noted: a blunter spire, side of spire more convex, and principally in the umbilicus being very much wider.

Rahula daflaensis, n. sp. (Plate CXVII. fig. 5.)

*Locality.* Dikrang Valley, Dafla Hills (*G.-A.*).

Shell deeply umbilicated, globosely conoid; sculpture distant, raised, oblique, sinuate costulation; colour pale sienna-brown; spire conic, sides slightly convex; suture moderately impressed. Whorls 7, convex, indistinctly angular at the periphery near aperture; aperture semiovate; peristome thin; the columellar margin scarcely thickened.

Size: major diam. 4·2, alt. axis 3·0 mm.

This interesting form can at once be distinguished by the absence of the lirate sharp keel of *R. bascauda* and its allies.

Rahula lhotaensis, n. sp. (Plate CXVII. fig. 6.)

*Locality.* Lhota Naga Hills, Assam (*Chennell*).

Shell openly and deeply umbilicated, pyramidal, base very flat, sharply keeled and carinate; sculpture, costulation close and regular, oblique and sinuate, extending to the basal side; colour rich brown (burnt-sienna); spire conical, apex pointed, sides slightly convex; suture fairly impressed, with a thin liration. Whorls 7, slightly convex; aperture quadrate, oblique; peristome thin, angulate on the lower outer margin; columellar margin subvertical, not thickened, slightly reflected.

Size: major diam. 5·0, alt. axis 4·9 mm.

This is a larger species than the type, and can be distinguished by its more pointed apex, pyramidal form, and very flat base, and the costulation is much closer and finer.

Rahula munipurensis, n. sp. (Plate CXVII. fig. 4.)

*Locality.* Munipur Hills, north-east of valley.

Shell globosely conic, deeply umbilicated, rounded below the keel, the liration on which terminates at the penultimate whorl; sculpture distant, very strong and very regular costulation; colour pale grey, the ribbing showing bright brown; spire conoid, side nearly flat; apex rounded; suture impressed. Whorls 6, regular, sides very convex; aperture semicircular; peristome fairly thickened; columellar margin subvertical.

Size: major diam. 3·5, alt. axis 2·25 mm.

This is a very distinct little species and the smallest of the genus. I have only found one specimen as yet among the minute Helices I collected in the Munipur Hills.

Genus Sophina, Benson.

(Plate CXV. figs. 5, 5 *a*; Plate CXVI. fig. 3.)

*Sophina*, Benson, Ann. & Mag. Nat. Hist. 1859, ser. 3, vol. iii. p. 473.

Type *Helix calias*, Benson.

Original description :—“ *Testa* Naninoidea ; *columella callosa, declivis, cum margine basali angulum efformans, angulo, nonnunquam rimato, carinam, plus minusve acutam, umbilicalem emittente.*”

After describing *H. calias*, Mr. Benson writes :—“ Less than a month had elapsed from the date of my paper announcing the peculiar formation of the columellar lip and umbilicus in the Tenasserim *H. forabilis*, B., when this shell reached me by the overland route, presenting, with a very different form, the same characteristic pillar lip and horizontal spiral keel at the umbilicus, on which I had so confidently relied for the future recognition of that species when it might be met with in a more perfect condition. The shell next to be described [*H. schistostelis*] offers a still more exaggerated development of the same type at the basal angle ; and, taken together, these shells may justly be regarded as types of a peculiar Southern Burmese section of the Naninoid group.”

In the ‘Annals & Magazine of Natural History’ for January, 1860, Benson gives amended characters of the genus *Sophina* and of the species *calias* and *forabilis* : from certain shell-characters he was at that time inclined to consider it Helicidous in character, but as the animal was unknown it was only a matter of conjecture. He concludes the paper by pointing out the limited area of the distribution of the three species he had then described, and I quote his last few lines, which are almost as applicable to-day as they were in 1859–60 :—“ It appears to be scarcely within the bounds of probability that a form so peculiar should be confined to the limited tract [that is, the limestone hills of Moulmein] in which it has hitherto been collected. Species may have been overlooked, or regarded by persons unacquainted with the subject as merely broken shells, both in the Malay Peninsula and in Siam,—possibly even in Cochin China. Other unusual Tenasserim types have occurred in the two countries last named.”

It was not until 1869 that Ferdinand Stoliczka visited Moulmein, and collected the living animals of *Sophina* and other species, which was followed by his excellent paper entitled “ Notes on Terrestrial Mollusca from the Neighbourhood of Moulmein (Tenasserim Provinces), with Descriptions of New Species,” Journ. Asiat. Soc. Bengal, 1871, p. 143.

On pages 252–255 Stoliczka gives an excellent account of the animal and all its parts, which cannot be added to, and this I shall largely make extracts from.

Among a collection of shells preserved in spirit made by and made over to me by Mr. Theobald, I find a species which I have determined as *S. calias*, from Mergui, which lies some 275 miles

down the coast south of Moulmein and enlarges the area of its distribution considerably. I may allude here to a record in Nevill's 'Hand-list,' i. p. 52, of a single specimen of *S. calias* in the Calcutta Museum, one out of Stoliczka's collection as coming from Biling, south of Pegu, which is some 75 miles north-west of Moulmein. This is a single specimen, the determination may not be correct, and this extension requires confirmation, particularly as Pegu is in quite a different geological and separate drainage-area of the Irrawaddy.

The animal of the Mergui shell on dissection agrees in every respect with Stoliczka's description, only that the generative organs (Plate CXVI. fig. 3) are in a much more advanced stage of development than was the case with those figured by Stoliczka (pl. xix. fig. 2), which are in a very attenuate stringy state.

I give a figure of the animal (Plate CXV. figs. 5, 5 *a*) removed from the shell, both from the right and left side, showing the ample shell-lobes and the very large and entire left shell-lobe. This shell was 14·75 mm. in major diameter, and is therefore referable to the variety of *S. calias* (*schistostelis*, Bs.), and shows most beautifully the second growth of the shell upon the earlier stage, and possesses a different surface, but in this case is quite solid, not thinner than the preceding whorls.

### *Extracts from Stoliczka's Description of* Sophina.

"The shells of *Sophina* are characterized by a more or less thickened columellar lip, forming with the basal portion of the outer lip an angle, and producing a ridge round the umbilicus; they are of small or median size, suborbicular shape, and thin structure.

"All of them (the species known) can fully retract their bodies in the shells, but sometimes with difficulty, as in *Helicarion*, to which *Sophina*, on account of the great development of the mantle-lobes, bears a close relation.

"The foot of *S. calias* is very elongated, rather narrow, with a very distinct lateral line, marked with oblique furrows above it, nearly smooth below it down to the edge of the sole. The posterior end is obliquely truncate, occupied by a large high gland and superseded by a distinct horn-like appendage. The sole has two longitudinal grooves, dividing it in three subequal parts, the inner being somewhat narrower than the outer parts; the grooves are usually well traceable in spirit-specimens, but during life they are not equally easily discernible. Pedicles about half the length of the body, tentacles about one-fourth the length of the pedicles, both with swollen tips. Mantle conspicuously thickened near the margin, its external edge very short, entire, and continuous. The left shell-lobe is very large, entire, reflected over the edge of the outer lip, and below considerably produced; the right mantle-lobe is divided into two parts, the upper is linguate, narrowly produced and covering the base of the shell, partially also extending on to

the upper surface of the penultimate whorl, as in *Macrochlamys*; the lower portion is shorter, somewhat folded and reflected over the columellar lip. The dorsal lobes are well developed and entire, the left is a little larger, and both are thickened round the pulmonary orifice; the right considerably extends over the side of the neck.

"The genital organs chiefly occupy the anterior part of the body. The arrow-sac is short and thick, with an enclosed, thick, pointed papilla. The uterus, accompanied by the prostata, is very long, thick, the former has a yellowish colour with a greenish tinge, the latter is purely white; terminal albuminous gland of moderate size, slightly thickened; hermaphrodite gland large, rather flatly depressed, connected with the uterus by a long twisted duct. The vas deferens branches off a short distance from the hermaphrodite opening: in about three-fifths of its length from its origin it has a long pointed appendage, consisting of strong tissue, filled with minute, elliptical, calcareous secretions; this appendage is attached by a special muscle close to the place of attachment of the arrow-sac; the last two-fifths of the vas deferens gradually widens and towards the end the simple tube consists internally of remarkably soft muscular tissue, but there is no papilla present. The receptaculum seminis is a globular gland, attached to a long slightly twisted string, originating from the oviduct quite close to the hermaphrodite opening.

"The jaw of *calias* is broadly semilunar, thin, apparently smooth, but when moderately enlarged and viewed in transparent light, a distinct concentric striation is perceptible, and there are some very minute radiating lines to be observed near the middle part.

"The radula is elongately quadrangular, consisting of about 35 to 50 transverse rows of teeth, meeting at sharp angles in the middle line; there are about 80–100 teeth in each row. They are all of a similar shape, pyramidal, sharply pointed and attenuated in the front, gradually becoming wider and terminating with an obtusely rounded base. The middle tooth is slightly contracted below the middle, it is symmetrical; the laterals are gradually more bent outwards on either side and possess on the outer side near the point a rounded and angular projection: the angle appears to be directed posteriorly; the outermost teeth are quite simple. The teeth of *S. discoidalis* and *conjungens* are exactly similar to those of *calias*, only comparatively smaller."

The genus *Sophina* is perhaps the most interesting in the family Zonitidæ; it is the most aberrant of all I have examined. It presents departure from the ordinary type, particularly from those which the form of the shell recalls. The most striking character is the radula; there is nothing approaching the peculiar simple form of the teeth in any known genus of the family. Next, the large, broad, left dorsal lobe, entire for its whole length, without a trace of a slit. This character is that of an old Peninsular India group

met with in *Nilgiria solata*, *N. tranquebarica*, and with a slight slit about halfway in *N. ligulata*, *N. chenui*, *N. basileus*. The peculiar structure of the columellar margin is possibly due to this mantle-lobe and the large left shell-lobe combined; the latter being tongue-like and extending far back, it would be close to and play around the umbilicus.

With regard to the distribution of *Sophina*, it is an interesting point whether it is the remnant of a genus at one period more widely spread than it is at present along the narrow belt of the Tenasserim coast, or whether it is of more recent and local development. The former seems to me to be the most likely, although there is no Indian genus at present known with which it can be linked up. It is the associate, as Stoliczka points out, writing of the physical features of Moulmein, of several very peculiar and interesting genera, which are known now to range further than when he wrote. There is a large extent of country yet to be explored to the northward, and species related to *Sophina* may be looked for on the flanks of the great gneissic backbone of the Malay Peninsula, and away into the Shan country and Upper Burmah.

It may even be looked for in the Nicobar Islands, for I have a single specimen, which came from Mr. de Roepstorff, which is marked "Andamans or Nicobar." It is peculiarly like *S. calias* in general colour and shape, even the columellar margin is thickened and sinuate; but being a single specimen and the actual locality doubtful, this doubt may extend its true habitat to the mainland, and that it found its way by exchange into the Roepstorff collection. I may say, however, that when going through his shells there were only two or three of doubtful authenticity.

SOPHINA CALIAS, Bens. (char. emend.).

*Sophina calias*, Bs. Ann. & Mag. Nat. Hist. 1859, ser. 3, vol. iii. p. 473; emend. 1860, ser. 3, vol. v. p. 26.

*Helix calias*, Pfr. Mon. Helic. vol. v. p. 112.

*Sophina calias*, Stoliczka, J. A. S. B. 1871, p. 143; Clessin, Nomen. Helic. 1881, p. 48 (placed between the genera *Thalassia* and *Hemiplecta*).

Original description:—"*Testa anguste umbilicata, orbiculato-depressa, solidiuscula, oblique striatula, polita, pallide cornea; spira planata, apice saliente, obtuso, sutura marginata, canaliculata; anfractibus 5 subconvexis, sensim accrescentibus, ultimo ad ambitum rotundato, subtus convexiusculo; apertura lunata, obliqua, peristomate recto, acuto, margine columellari oblique recurvatim descendente, calloso, extus crenulato, cum basali angulum fere rectum, arcte rimatum, efformante, rima extremitatem carinæ umbilicalis, sensim spiraliter intrantis, incidente; umbilici perspectivi pariete intus horizontaliter confertim sulcato.*

"Diam. major 9, minor $7\frac{1}{2}$, axis 4 mill.

"Habitat prope Moulmein, ad cavernas 'Farm Caves' dictas."

Benson described a species, *S. schistostelis*, also from Moulmein, at the same time as he described *S. calias*. Stoliczka, on good grounds and with the animals before him, considers this only a variety and due to increased growth of the shell. I give his description of the variety *schistostelis* (pl. xix. fig. 8) and the very interesting instructive remarks that follow it (pp. 255–57):—

"*Testa ultimo anfractu multo majore, tenui, pellucido; apertura semilunari, marginibus tenuissimis; labro columellari modice obliquo, levi, supra reflexo, labro supra paulo flexuose producto, ad basin fere recto; carina umbilicali distincta, tenui, ad aperturam paulo incisa.*

"Diam. maj. spec. max. 17 mm.; diam. min. 14·5; axis 8·5; alt. testæ 11, alt. apert. 8, lat. apert. 9 mm.

"The species offers a remarkable instance of variation during different stages of growth. As the type I consider the smaller form with a solid shell, the columellar lip very oblique and rugose, the outer lip obtuse and internally slightly thickened, and the umbilical ridge with a deep incision. This type is represented in fig. 7, on plate xix. Small specimens, measuring only 5 mm. in the larger diameter, occur of exactly the same form; it seems, therefore, that they often attain maturity at an early state.

"Very commonly, however, it is the case that the shells grow further after they have attained that certain stage of maturity. The increase amounts from one third sometimes to one and a half circuit of a whorl, as indicated in the fig. 8 *b*. This additional portion of the shell is always thinner than the rest and more transparent, the outer lip of the aperture is at the suture less produced on to the penultimate whorl, the columellar lip less oblique, thin, smooth, and the umbilical ridge is only slightly incised. In this stage the species was described by Benson as *Soph. schistostelis*, and it is certainly a most marked variety. There can, however, be no doubt that it is only an abnormal growth, for when the terminal half of the last whorl, indicated in fig. 8 *b*, is broken away, a typical *Soph. calias* of the shape represented in figs. 7, 7 *a*, 7 *b*, can be obtained.

"There appears to be no rule as to the size of the shell at which the abnormal growth begins (or, in other words, at which *S. calias* is changing into *S. schistostelis*), but the latter is locally so constant that very few specimens stop growth at the normal stage, while the abnormal forms are met with in thousands. It is really difficult to decide in such cases whether we ought to call these abnormal forms distinct species or not. But the fact clearly shows how species are developed one out of the other. In this case no one will doubt the propriety of regarding the larger form as an abnormal growth of the smaller one, because the original type can still be traced. But supposing the peristome of the normal shell had been entirely absorbed, and then the growth proceeded as usually; in such a case it would be much more difficult, and sometimes quite impossible, to trace the connection of the two forms, which could then with more propriety be acknowledged as two distinct species.

"The animal is whitish or pale fleshy grey, slightly darker on the head and on the pedicles and tentacles; mantle white in young, grey near the edge in older specimens; posterior end of foot often tinged grey.

"*Hab.* The species is very common on the limestone hills to the east and south of Moulmein."

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There have been many causes for the great delay in bringing out another part of this work, no less than seven years having slipped by. I much regret this; the only excuse I can offer is that over the causes I have had but little control.

In the period between 1882 and 1888, that of Vol. I., my time was much more my own, and I could work with some degree of regularity. In later years it has only been now and then that I could find time for the examination of material that came to hand, and some of this time was given to the preparation of papers for scientific journals treating of important or little-known genera. The new material has been so large in one family alone, the Zonitidæ, that I have deemed it best to continue working at species of the numerous genera it contains, in preference to taking up genera of the freshwater forms, the morphology of which is so well known, although of the Indian genera, both among the Gasteropoda and Pelecypoda, very much has to be done specifically.

I must here refer to one who took a great interest in this work: Dr. William T. Blanford, C.I.E., F.R.S., &c., who passed away on the 23rd of June, 1905, at the age of 72. I had enjoyed his help and friendship since 1864, and had it not been for his assistance and that of his brother Henry this work would never have been entered upon. They afforded the right helping hand just at the time I began to seriously collect.

From 1863 onwards I was in correspondence with them, exchanging specimens and gaining knowledge. When friendships such as these, cemented by a mutual bond of interest in Natural History, are brought to an end, the void can never be filled, the loss is daily felt.

Of William Blanford's career in the Indian Survey and the work he achieved, I would refer the reader to the Obituary Notices which appeared in many of the Journals of Scientific Societies.

Blanford had a vast knowledge of the Mollusca of India, and of their distribution particularly; it was, in fact, the first Natural History investigation undertken by him in the field on his first arrival in India, and eventually his duties led him to see the greater part of that country with Persia and Abyssinia. It was the last work he was engaged upon, in connection with the 'Fauna of British India' series. It is much to be deplored that he was not spared to complete what he had begun, for with Blanford's death a vast store of knowledge died also, which would have found a place in that

series, in the volume assigned to the Mollusca. He wrote a great number of excellent papers teeming with original and suggestive ideas, which only one with his knowledge of the physical and geological characters of the country could have conceived, beginning with the "Contributions to Indian Malacology, I.–XII.," 1861–1880, the first two in association with his brother. I cannot do better than quote from what Col. A. W. Alcock, Superintendent of the Calcutta Museum, says of him in the 'Records of the Geological Survey of India,' vol. xxxii. pt. 4:—

"To those interested in the finer problems of zoology the most taking parts of Blanford's work are his essays on the geographical distribution of Indian animals. This subject, indeed, was at the back of all his systematic papers, and was separately treated by him, in a tentative way, as early as 1870. But in 1876 he published, in the 'Annals and Magazine of Natural History,' a critical and constructive paper, in which the elements of the Indian vertebrate fauna are segregated from a physiographical standpoint, their relations to the Ethiopian fauna are emphasized, and the argument that certain common elements suggest a vanished land-connection between South Africa and the Indian Peninsula is clearly stated.

"Twenty-five years later the material accumulated in the compilation of the 'Fauna of British India' was used by him for an exhaustive examination of this subject, and in 1901 he crowned his zoological work with an elaborate essay, entitled 'The Distribution of Vertebrate Animals in India, Ceylon, and Burma,' which was published in the 'Philosophical Transactions of the Royal Society.'

"In this fine monograph the entire land and freshwater vertebrate fauna of the region is critically analyzed by genera, and is split, by considerations of habitat, into definite geographical units; these, again, are recombined into subregions, the relations of which to each other, to neighbouring zoological regions, and to past geological land-connections and former geological climates being minutely and most effectively discussed.

"It was characteristic of Blanford, in connection with this subject upon which his profound knowledge of cognate branches of natural science entitled him to speak with authority, that his views were expressed with singular moderation. Though he was among the first to realize that modern zoological regions which ignore past geological changes *on the large scale* must be artificial, and, conversely, that instances of what are commonly regarded as anomalies of distribution may possibly afford evidence of those very changes, he allowed his opinions to mature before giving utterance to them."

Some of the results of the work contained in the previous Parts, together with papers contributed to the Malacological Society's 'Proceedings' since 1899, were partly referred to in my Presidential Address to that Society, and also by my friend and fellow-worker for many years, Dr. W. T. Blanford; and, as I show further on, it was not a little satisfaction to find he accepted some of my views regarding distribution—a subject on which

there was no one better qualified to write, both from his vast knowledge of the country and its fauna, particularly of the Vertebrates.

In a paper entitled "Notes on *Ariophanta*, *Xestina*, *Nilgiria*, and *Euplecta*, with Lists of Species," read June 1901, Blanford says in the opening part:—"We are indebted to Colonel Godwin-Austen for the remarkable discovery that in certain areas of the Indo-Malay (Indian or Oriental) region, members of the Limacidæ (Zonitidæ) having shells so diverse that they were formerly classed in distinct genera, or even in some cases in different families or subfamilies, agree amongst themselves in each area and differ from those in other areas by characteristic details in the anatomy—details which, in the presence of the extraordinary similarity which prevails throughout the greater portion of the Terrestrial Pulmonata, are sufficient to distinguish each local group. This discovery has entirely upset all previous attempts at the classification of the Indo-Malay Limacidæ, and at present we can only arrange the species known in provisional local generic sections.

"A considerable proportion of the larger forms of Limacidæ in Peninsular India and Ceylon, formerly referred to Malayan and Philippine genera like *Hemiplecta* and *Xesta*, have now been shown to belong to one or another of the genera cited in the title of this paper. In consequence of Godwin-Austen's recent work, some of the results of which, not yet published, he has communicated to me, it is now practicable to arrange generically many of the species known to occur in the zoological subregion consisting of India south of the Himalayas and Ceylon—the area which I have proposed to call the Cisgangetic Subregion. It is true that the animals of several species in addition to those already dissected require examination before their affinities can be correctly ascertained, but still an attempt can now be made at classification.

"Amongst the species that still require examination are *Helix basileus* *, Bs. (the shell of which closely resembles that of certain Siamese forms of *Hemiplecta*), *H. basilessa*, Bs., *H. concavospira*, Pfr., and *H. apicata*, Blf.

"In drawing up lists of the species, it must be understood that I accept Godwin-Austen's view ('Land and Freshwater Moll. Ind.' vol. i. p. 133; vol. ii. p. 82) that *Ariophanta* should be restricted to Indian (Cisgangetic) species; also that his subgenus *Nilgiria* (*op. cit.* vol. ii. pp. 77, 81, 123) is distinguished from *Ariophanta* solely by having dextral instead of sinistral shells—a character which I agree with him in regarding as of no real importance,—and that for the present, at all events, the genus *Euplecta* (*op. cit.* vol. ii. p. 96) should be confined to forms inhabiting India and Ceylon."

In 1899 † I wrote as follows:—"When one examines the genera from South India and Ceylon, one cannot but fail to be impressed with the many important points in their anatomy which differentiate

* Since described and placed in the genus *Ariophanta* (*Nilgiria*), Proc. Malacol. Soc. Lond. vol. v. pt. 3 (Oct. 1902).

† Proc. Malacol. Soc. Lond. vol. iii. pt. 5 (July 1899).

them from genera of the same family occupying other parts of India. Without enumerating the many genera and species of other families which are quite peculiar and restricted to this Peninsula, the number of genera I have brought to your notice in this Address is large and characteristic of isolation. Nor is this more than might be expected as the result of the past conditions over a considerable part of this area. The geological evidence indicates that this part of India is one of the oldest of land-surfaces on the globe. Ever since the East and West Cretaceous oceans washed its shores, the fringing line of which is preserved at different points, some part of it at least remained dry land. Very similar conditions appear to have existed during Nummulitic times; and not until the advent of the Eocene does there appear to have been any connection with Palæarctic lands and faunæ on the north-west."

What Blanford did for the distribution of the Indian vertebrate fauna has to be done for the invertebrates; and of these the Mollusca can best be treated by themselves. The means of migration of land-shells are limited and progress is slow; it is stopped abruptly by physical change of conditions. A forest form cannot cross a hot sandy tract of even a few miles in width. They are in a great measure attached to their habitat: they would be less affected by terrestrial disturbances than vertebrates, and survive changes which would destroy or drive out the latter.

It is apparent that the distribution of the Land Mollusca does not conform in every way with that of the Vertebrata; in one sense it is more intimately connected with physical features long since vanished. This is shown in the south in Peninsular India, which is undoubtedly a very ancient land-surface *. Again, in the north, in Assam †, from the base of the Eastern Himalaya, the great gneissic mass of Bhutan, the Aka and Dafla Hills, towards Brahmakund points to another ancient land, presumably so, for not far distant were in succession the shores of the Cretaceous, of the Nummulitic, and Tertiary seas. Earlier than these times the present base of the mountain-range would appear to have been near the northern deposition of the Gondwana Series, which is found turned up and inverted by overthrust at its junction with the gneissic rocks, with the Tertiaries on the south resting unconformably on the Damudas ‡, a feature which, absent at intervals, extends for some 350 miles between long. 86° 30′ and long. 94° E.

This extension of the Gondwana system from the northern side of Peninsular India, across the Gangetic plain to the eastward into Assam, is the link which unites the two ancient land-areas §.

Is it not something more than a mere accident that in Peninsular India we find species belonging to genera peculiar and restricted to that part of India, such as *Ariophanta*, *Euplecta*, &c., and on reaching the mountain-slopes of the Eastern Himalaya so many very peculiar species and genera come in which have not been met with even in

* Man. Geol. India, Medlicott & Blanford, 1879, p. 291.
† Man. Geol. India, Oldham, 1893, p. 488.
‡ J. A. S. B. vol. xliv. pt. 2, p. 35 (1875).
§ Man. Geol. India, 1879, pp. 618–620.

the well-worked area of the Garo, Khasi, and Jaintia Hills? I may mention a few of these: *Macrochlamys richilaensis*, *sathilaensis*, and *zemoensis*, with a free cæcum, from which we may conclude that species with the typical coil have been derived; *Dalingia*, *Staffordia*, and a slug-like form described as *Testacella? dikrangensis*, G.-A.*, a most peculiar shell, animal not known, but certainly not a *Testacella*. That remarkable slug *Anadenus* is a common species in Sikkim and Nepal, and has spread westward to Gurhwal and Simla Hills, just as *Alcæus* and *Diplommatina* are represented there by only two or three species. *Anadenus* no doubt extends throughout the extent of the as yet unworked Bhutan Himalaya, for I have lately recorded from Calcutta a fine new species found in the hills of North-east Munipur.

The extent and direction of this old land has to be traced, but it appears to lie in an eastern direction, several species being common to Eastern Assam and Upper Burmah. The axis of elevation of the Khasi Hills is comparatively recent post-Tertiary; its molluscan fauna could easily have been derived from the north and east and become modified.

If we consider the generally accepted zoological regions, there are conditions and forces affecting the distribution of the Mollusca which do not apply to the vertebrate and many invertebrate animals—such as dispersal on the lines of main drainage.

A glance at the map of India, on longitude 84° E., shows two great rivers, the Gandak and Kosi, having their sources in the main range of the Himalaya and joining the Ganges just above Rajmahal, where that river washes the base of those hills. Further to the east is the Teesta draining Sikkim, the Am Mochu or Toorsa, the Gudhadhur and Manass the mountains of Bhutan, with many considerable intermediate rivers. The outer ranges through which these rivers flow are clothed with a dense forest-growth, often down to the water's edge, which continues for many miles after the rivers leave the mountains to flow through what is called the Terai; and beyond this, where the great grass-plains begin and the cultivated area is entered, many of the watercourses have their banks fringed with forest, which, before the advent of Man on the scene and his annual burning of the grass, no doubt covered a far larger area of the plain country than it does now.

It follows that there has been a natural transport of the Mollusca inhabiting the mountain country southward. With the rise of the rivers during the rains thousands must be washed off the banks. Snails are not killed immediately by immersion in fresh water; they might be carried far down, be washed up on the bank, and finally crawl away into safety in the adjoining jungle-growth. Besides, there are many ways in which they might be carried even further, inside bamboos or on floating trees.

I think it is safe to consider that the molluscan fauna of the great delta of the Ganges and Brahmaputra has had its origin in the Himalayan slopes. Several Calcutta species and those of the Rajmahal Hills find their nearest allies anatomically in species

* J. A. S. B. vol. xlv. pt. 2 (1876).

inhabiting the mountains of Sikkim. Conchologically they have been there sufficiently long to become specifically distinct; this applies more especially to species that are vegetable-feeders and crawl about on shrubs, like so many of the genus *Macrochlamys*. A certain number, such as the operculated forms, although subjected to a like water transport, do not become introduced. Living exclusively, or as a rule, on rock-surfaces, they cannot so easily become settlers in a delta, where conditions of swamp, mud or sand, prevail. However, Cyclophoridæ of the Rajmahal Hills may possibly be the descendants of migrants from the northward.

In conclusion, I trust that the anatomical details of the numerous species now examined and published will give malacologists a better indication of their generic position, and in the case of some species render that position less uncertain than it has hitherto been. Such details are the only sure guide to an exact knowledge of the range of genera and species on which speculations relating to their distribution can be with certainty founded. So far as the Land Mollusca re concerned, I think there are sufficient grounds for the establishment of very different zoological regions in this part of the world, and I hope, after the examination of certain species I am endeavouring to obtain, I may be able to work out this subject in greater detail.

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## EXPLANATION OF PLATE CI.

*Bensonia camura*, Benson. Sikkim.

Fig. 1. Shell, natural size.
1 *a*. Ditto, × 2·5.
2. Mantle-edge and right dorsal lobe, × 2·5.
3. Extremity of foot, × 8.
4. Mantle-edge and anterior part of visceral sac, × 4·5.
5. Genitalia, removed from the animal, × 4·5.
5 *a*. Ditto, seen from right side before removal, × 4·5.
5 *b*. Ditto, seen from left side before removal, × 4·5.
6. Jaw, × 12.
7. Radula, part of, × 368.

*cæ*, cæcum; *rec*, rectum; *r.o*, renal organ; *ov*, oviduct; *P*, penis; *v.d*, vas deferens; *k*, kalk-sac; *sp*, spermatheca; *D*, amatorial organ or dart-sac; *rmP*, *rmD*, retractor muscles of penis and dart-sac.

## EXPLANATION OF PLATE CII.

*Dalingia bhutanensis*, n. sp. Bhutan Hills.

Fig. 1. Shell, natural size.
1 *a*. Ditto, front view, × 2·5.
2. Mantle-edge, showing dorsal lobes seen from above, × 4·5.
2 *a*. Ditto, showing dorsal lobes viewed from below, × 4·5.
3. Portion of peripodial margin of the foot, × 8.
4. Generative organs, × 4·5.
4 *a*. Ditto, male organ, reverse side, × 4·5.
4 *b*. Ditto, albumen-gland &c., × 4·5.
5. Jaw, × 12.
6. Teeth of the radula at different parts of the row, × 368.

## EXPLANATION OF PLATE CIII.

| | | |
|---|---|---|
| Fig. 1. | *Rahula macropleuris*, Bs., × 4·5. | Sikkim. |
| 2. | *Kaliella richilaensis*, n. sp., × 8. | Ditto. |
| 2 *a*. | —— ——, var., × 8. | |
| 2 *b*. | —— ——, sculpture of shell, fig. 2 × 58. | |
| 3. | —— *flatura*, G.-A., × 8. | Ditto. |
| 4. | —— *sikkimensis*, G.-A., Nevill MS., × 8. | Ditto. |
| 5. | —— *shillongensis*, n. sp., × 8. | Khasi Hills. |
| 6. | —— *fastigata*, n. sp., × 8. | Sikkim. |
| 7, 7 *a*. | —— *bhutanensis*, n. sp., × 12. | Bhutan. |
| 8. | —— *jaintiaca*, G.-A., × 8. | Jaintia Hills. |
| 8 *a*. | —— ——, sculpture, × 58. | N. Cachar Hills. |
| 9. | —— *rissomensis*, n. sp., × 8. | Bhutan. |
| 9 *a*. | —— ——, sculpture, × 58. | |
| 10. | —— *paucistriata*, n. sp., × 8. | Dafla Hills. |
| 11. | —— *nagaensis*, G.-A., sculpture, × 58. | Naga Hills. |
| 12. | —— *daflaensis*, G.-A., sculpture, × 58. | Dafla Hills. |

## EXPLANATION OF PLATE CIV.

*Macrochlamys tugurium*, Benson. Sikkim.

Fig. 1, 1 *a*. Shell, natural size.
1 *b*. Ditto, enlarged, × 2·5.
2. Animal, with shell removed, to show right shell-lobe and visceral sac, × 1·5.
3. Extremity of foot, × 8.
4. Part of animal, showing mantle-edge, visceral sac, and character of its markings, × 4·5.
5. Genitalia, × 4·5.
5 *a*. Ditto of another specimen, penis and spermatheca, × 4·5.
5 *b*. Ditto, male organ, reverse side, × 4·5.
6. Jaw, × 12·5.
7. Teeth of radula at various parts of a row, × 368.

## EXPLANATION OF PLATE CV.

*Macrochlamys richilaensis*, n. sp. Bhutan.

Fig. 1, 1 *a*. Shell, nat. size and enlarged, × 2·5.
1 *b*. Animal, with shell removed, showing visceral sac &c., × 2·5.
1 *c*. Generative organs, × 4·5.
1 *d*. Jaw, × 12.
1 *e*. Teeth of radula, central and two side teeth, × 368.
1 *f*. 18th to the 26th teeth, × 368.
1 *g*. Outermost teeth, × 368.

*Macrochlamys damsangensis*, n. sp. Bhutan.

Fig. 2, 2 *a*. Shell, nat. size and enlarged, × 2·5.
2 *b*. Animal, with shell removed, showing visceral sac &c., × 2·5.
2 *c*. Mantle-edge, showing shell-lobes, × 2·5.
2 *d*. Part of penis near retractor muscle, × 24.
2 *e*. Jaw, × 12.
2 *f*. Radula, part of: 16th to the 26th teeth, × 368.

## EXPLANATION OF PLATE CVI.

*Macrochlamys sequax*, Bs. Darjiling. (Ex Blanford Collection.)

Fig. 1. Shell, × 2·4 : typical.
1 *a*. Genitalia, × 8.
1 *b*. Jaw, × 24.
1 *c*. Admedian teeth of radula, 10th to 16th.
1 *d*. Outermost teeth.

*Macrochlamys sequius*, n. sp. Damsang.

Fig. 2. Shell, × 2·5.
2 *a*. Animal, viewed from left side: shell removed, showing visceral sac, × 8.
2 *b*. Edge of mantle, showing shell- and neck-lobes, × 4.
2 *c*. Ditto, showing left shell-lobe.
2 *d*. The generative organs, × 8.
2 *e*. Kalk-sac or flagellum, with spermatophore forming.
2 *f*. Jaw, × 24.
2 *g*. Portion of row of radula, 8th to 15th admedian teeth.

*Macrochlamys sequax* ?, Bs. Darjiling. (From Colonel Mainwaring.)

Fig. 3. Right side: right shell-lobe in life.
3 *a*. Ditto: ditto, more extended.
3 *b*. Extremity of foot in life.

*Macrochlamys sathilaensis*, n. sp. Richila.

Fig. 4. Shell, × 2·5.
4 *a*. Part of the generative organs, × 4·5.
4 *b*. The penis (*cæ*, cæcum), × 8.
4 *c*. Jaw, × 12.

## EXPLANATION OF PLATE CVII.

*Austenia silcharensis*, n. sp. Cachar.

Fig. 1, 1 *a*, 1 *b*. Shell, × 2·4.
2. Animal, view of right side, showing the large shell-lobes, × 4·5.
2 *a*. View of the left side, × 2.
3. Part of generative organs: amatorial organ, spermatheca, × 12·4.
3 *a*. The male organ detached from above, × 12·4.

*Austenia zemoensis*, n. sp. Sikkim.

Fig. 4, 4 *a*. Shell, × 2·5.
5. Animal, view of right side, × 4·5.
5 *a*. Ditto, left side, × 4·5.
6. Edge of mantle, detached, showing left shell-lobe and left dorsal lobe, × 4·5.
7. Extremity of foot, × 4·5.
8. Anterior portion of the visceral sac, × 4·5.
9. The genitalia, × 12.

## EXPLANATION OF PLATE CVIII.

Fig. 1, 1 *a*, 1 *b*. *Macrochlamys beata*, n. sp., × 2·5.
2, 2 *a*, 2 *b*. —— *razamiensis*, n. sp., × 2·5.
3, 3 *a*, 3 *b*. —— *mahadeoensis*, n. sp., × 2·5.
4, 4 *a*, 4 *b*. —— *hengdanensis*, n. sp., × 2·5.
5, 5 *a*, 5 *b*. *Austenia durrangensis*, n. sp., × 2·5. See Plate CXI. figs. 7–7 *c* (animal).

## EXPLANATION OF PLATE CIX.

*Macrochlamys hodgsoni*, Bs. (Blanford MS.).

| | | |
|---|---|---|
| Fig. 1. | Shell, × 4 : typical. | Darjiling. |
| 1 *a*. | Sculpture, × 75. | Ditto. |
| 2. | Shell, × 4·5. | Western Sikkim. |
| 2 *a*. | Animal, left side, × 12·4. From spirit-specimen. | Ditto. |
| 2 *b*. | Ditto, right side, × 12·4. From spirit-specimen. | Ditto. |
| 2 *c*. | Central and outer teeth of radula. | Ditto. |
| 2 *d*. | Jaw, × 58. | Ditto. |

*Macrochlamys rorida*, Bs. Darjiling.

| | | |
|---|---|---|
| Fig. 3. | Shell, × 4 : typical. | |
| 3 *a*. | Foot. | |
| 3 *b*. | Mantle-zone, with shell- and dorsal lobes. | |
| 4. | *Macrochlamys fragosus*, n. sp., × 4. | Dafla Hills. |
| 5. | —— *perfragilis*, Nevill MS., × 4. | Sikkim. |
| 6. | —— *superflua*, W. Blf., very young, × 7. | Darjiling. |
| 7. | —— *sequius*, G.-A., very young, × 7. | Ditto. |
| 8, 8 *a*. | —— *spreta*, W. T. Blf., × 4. | Pegu. |
| 9. | —— *salwinensis*, n. sp., × 4. | Tenasserim. |
| 10, 10 *a*. | —— *hookeri*, n. sp., × 2·4. | Cherra Poonji. |

## EXPLANATION OF PLATE CX.

*Macrochlamys zemoensis*, n. sp. Sikkim.

Fig. 1, 1 *a*. Shell, × 2·5.
1 *b*. Visceral sac, × 4·5.
1 *c*. Animal, right side, from spirit-specimen, × 4·5.
1 *d*. Ditto, left side, ditto.
1 *e*. Buccal mass and salivary gland : *j*, jaw, × 4·5.
1 *f*. Generative organs, amatorial separated from, × 12.
1 *g*. Jaw, × 30.
1 *h*. Central and side teeth of the radula, × 368.

*Macrochlamys rakaensis*, n. sp. Sikkim.

Fig. 2. Shell, × 4·5.
2 *a*. Visceral sac, × 4·5.
2 *b*. Head with mantle-zone and shell-lobes.
3. *Bensonia camura*, Bs. : visceral sac, to show the typical marking of, × 4·5.

## EXPLANATION OF PLATE CXI.

*Taphrospira bathycharax*, Bs., MS. South Andaman.

Fig. 1. Part of animal from left side, showing left shell-lobe and extremity of foot, × 4·5.
1 *a*. Right shell-lobe, × 4·5. (*v.s.*, visceral sac.)
1 *b*. Jaw, × 12.
1 *c*. Genitalia, × 8.
1 *d*. Left dorsal lobe and left shell-lobe, viewed from below, × 8. (*m*, mantle-zone.)
1 *e*. Part of the spermatheca, × 24, with portions of capsules of spermatophores.
1 *f*. Flume of a spermatophore, from above.

*Macrochlamys exul*, Theobald. South Andaman.

Fig. 2. The mantle-zone removed from the animal: the right and left shell-lobes, × 4·5.
2 *a*. The right shell-lobe, × 8.
2 *b*. The genitalia, × 8.
2 *c*. Jaw, × 24.
2 *d*. Teeth of the radula at different parts of the row.

*Sarika resplendens*, Phil. Mergui.

Fig. 3. Genitalia, with a spermatophore, × 4·5.
3 *a*. End of the dart, × 4·5.

*Macrochlamys beata*, G.-A. Dafla Hills.

Fig. 4. Teeth of the radula at different parts of the row, × 550.

*Macrochlamys razamiensis*, G.-A. Naga Hills.

Fig. 5. Teeth of the radula at different parts of the row, × 550.
5 *a*. Jaw, × 24.

*Macrochlamys mahadeoensis*, G.-A. North Cachar Hills.

Fig. 6. Teeth of radula, × 500.

*Austenia durrangensis*, G.-A. Durrang District, Assam.

Fig. 7. Part of the animal on the right side, near aperture: shell-lobes, × 8.
7 *a*. Ditto, left side, showing left shell-lobe, × 8.
7 *b*. Jaw, × 24.
7 *c*. Central teeth of the radula, × 550. Laterals near the 45th tooth, × 950.

## EXPLANATION OF PLATE CXII.

*Philalanka thwaitesi*, Pfeiffer. Ceylon.

Fig. 1. Generative organs, × 12·5.
1 *a*. Jaw, × 163.
1 *b*. Jaw, the edge of, × 196.
1 *c*. Teeth of radula at different parts of a row, × 1100.

*Thysanota crinigera*, Benson. Southern India.

Fig. 2. Animal removed from the shell, showing foot, visceral sac, and mantle-edge.
2 *a*. Teeth of the radula at different parts, × 920.
2 *b*. Jaw, central part of, × 196.
2 *c*. Jaw, × 24.
2 *d*. Buccal mass and salivary gland &c., × 12.

*Sykesia biciliata*, Pfeiffer. Ceylon.

Fig. 3. Generative organs, × 12.
3 *a*. Buccal mass, × 12.
3 *b*. Teeth of radula at different parts of the row, × 920.
3 *c*. Spatulate epidermal hairs of shell, × 24.

## EXPLANATION OF PLATE CXIII.

*Staffordia daflaensis*, G.-A.

Fig. 1. Shell, × 2·4.
1 *a*. Animal, 1st specimen found, drawn from life.
1 *b*. Ditto, ditto, extremity of foot.
1 *c*. Foot, spirit-specimen, × 4·5.
1 *d*. Animal from right side, showing right shell-lobe.
1 *e*. Ditto from left side, showing left shell-lobe, × 4·5.—Part of branchial wall removed, showing penis and its retractor muscle, × 4·5.
1 *f*. Jaw, × 12.
1 *g*. Teeth of radula at different parts of the row, × 360.
1 *h*. Genitalia, 1st specimen dissected, × 5.
1 *i*. Ditto, 2nd specimen dissected, × 4·5.
2. *Staffordia daflaensis*, var., × 2·4.
3. —— ? *toruputuensis*, G.-A., × 2·4.
4. —— *staffordi*, G.-A., × 2·4.

## EXPLANATION OF PLATE CXIV.

*Euplecta hyphasma*, Pfeiffer. Ceylon.

Fig. 1. Genitalia, × 12.
1 *a*. Posterior end of penis, showing spermatophore in process of formation, × 24.

*Plectopylis pinacis*, Bs. Lamsang, Sikkim.

Fig. 2. Side of visceral sac, distant one whole whorl from the aperture, showing position of the heart and kidney and part of oviduct. Drawn by eye.
2 *a*. Genitalia, the oviduct broken and emptied of embryonic shells, × 4·5.
2 *b*. Distal end of oviduct with embryos in different stages of development, the hermaphrodite-duct and albumen-gland, part of intestine and mucous glands, × 4·5.
2 *c*. Jaw, × 12·4.
2 *d*. Teeth of radula at various parts of the row, × 570.

*Corilla gudei*, Sykes. Ceylon.

Fig. 3. Right side of foot, × 8.
3 *a*. Animal partly withdrawn into aperture, showing shell- and dorsal lobes, × 4·5.
3 *b*. Buccal mass and salivary glands, × 4·5.
3 *c*. Portion of liver, showing structure, × 8.
3 *d*. Teeth of radula at various parts of the row, × 368.
3 *e*. Jaw, × 12.
3 *f*. Generative organs, × 4·5.
3 *g*. Ditto, terminal end of spermatophore, × 12.

*Thysanota guerini* Pfr. Nilgherries.

Fig. 4. Jaw, × 12.

## EXPLANATION OF PLATE CXV.

*Leptodontarion hiraseanus*, Pilsbry. South Formosa.

Fig. 1. Animal, view of the right side, from a spirit-specimen, × 4·5.
1 *a*. Ditto, left side.
1 *b*. Shell, × 4·5.

*Petalochlamys formosana*, Schmacker & Boettger, var. *hypograpta*, Pilsbry & Hirase. South Formosa.

Fig. 2. Animal, part of the right side and foot, × 4·5.
2 *a*. Ditto, left side and foot, × 4·5.
2 *b*. Shell, × 4·5.

*Lamprocystis fulgida*, n. sp. South Formosa.

Fig. 3. Foot of the animal, with shell, viewed from above and right side, × 4·5.
3 *a*. Animal, viewed from the left side, × 4·5.
3 *b*. Extremity of foot, × 12·4.
3 *c*. Ditto, showing mucous gland and sole of the foot, × 12·4.
3 *d*. Right shell-lobe and portion near the rectum, × 12·4.
3 *e*. Shell, front view, × 4·5.
3 *f*. Ditto, from above, × 4·5.

*Durgella rogersi*, n. sp. South Andaman Islands.

Fig. 4. Animal, viewed from the right side, × 4·5.
4 *a*. Ditto, viewed from the left side, × 4·5.

*Sophina calias*, Benson. Mergui.

Fig. 5. Animal, part of, showing right shell-lobe, × 4·5.
5 *a*. Ditto, view of the left side and extremity of foot, × 4·5.

## EXPLANATION OF PLATE CXVI.

*Sarika pumicata*, Morelet. Siam.

Fig. 1. Genitalia, parts separated, × 4·5.
1 *a*. Mantle-edge removed, showing shell- and dorsal lobes, × 4·5.
1 *b*. Teeth of the radula at different parts of the row, × 368.
1 *c*. Jaw, ×12.

*Sarika resplendens*, Phil. Mergui.

Fig. 2. Mantle-edge removed, showing shell- and dorsal lobes, × 4·5.
2 *a*. Teeth of radula at different parts of the row, × 368.
2 *b*. Jaw, × 12.

*Sophina calias*, Bs. Mergui.

Fig. 3. Generative organs, ×4·5.

*Leptodontarion hiraseanus*, Pilsbry. South Formosa.

Fig. 4. Genitalia, part of, × 4·5.
4 *a*. Spermatheca and adjacent parts, × 12.
4 *b*. The male organs, × 12.
4 *c*. Teeth of the radula at different parts of the row, × 1100.
4 *d*. Jaw, × 30.

*Petalochlamys formosana* var. *hypograpta*, Pilsbry & Hirase. South Formosa.

Fig. 5. Portion of generative organs, penis &c., × 4·5.
5 *a*. Teeth of the radula at different parts of the row, × 1100.
5 *b*. Jaw, × 30.

*Lamprocystis fulgida*, n. sp. South Formosa.

Fig. 6. Teeth of the radula at different parts of the row, × 1100.
6 *a*. Jaw, × 30.

*Durgella rogersi*, n. sp. South Andaman.

Fig. 7. Teeth of the radula, × 1100.
7 *a*. Jaw, × 30.

## EXPLANATION OF PLATE CXVII.

| | | |
|---|---|---|
| Fig. 1. | *Rahula bascauda*, Penson: costulation fine and close, × 7. | Teria Ghat. |
| 1 *a*. | Ditto: costulation distant, × 7. | Ditto. |
| 2. | *Rahula polypleuris*, W. T. Blf., × 7. | Arakan. |
| 3, 3 *a*. | —— *bascauda*, Bs., × 7. | Jaintia. |
| 4. | —— *munipurensis*, n. sp., × 7. | Munipur Hills. |
| 5. | —— *daflaensis*, n. sp., × 7. | Dafla Hills. |
| 6. | —— *lhotaensis*, n. sp., × 7. | Lhota Naga Hills. |
| 7. | —— *bascaudula*, n. sp., × 7. | Sikkim. |
| 8. | *Macrochlamys* (*Lamprocystis*?) *fulgens*, Gude, from type, × nearly 4. | Lu-chu Islands. |

# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA,

INCLUDING

SOUTH ARABIA, BALUCHISTAN, AFGHANISTAN, KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM, MALAY PENINSULA, CEYLON, AND OTHER ISLANDS OF THE INDIAN OCEAN.

SUPPLEMENTARY TO MESSRS. THEOBALD AND HANLEY'S

CONCHOLOGIA INDICA.

BY

LIEUT.-COLONEL H. H. GODWIN-AUSTEN,
F.R.S., F.R.G.S., F.Z.S., &c.,
LATE DEPUTY SUPERINTENDENT TOPOGRAPHICAL SURVEY OF INDIA, IN CHARGE OF THE KHASI, GARO, AND NAGA-HILLS SURVEY PARTY.

VOL. II.

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**Part XI.—MARCH 1910.**

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# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA.

## VOL. II.

**Part XI.—MARCH 1910.**

(Plates CXVIII.-CXXXII.—*March* 1910.)

## INTRODUCTION.

SINCE the last part was brought out in April 1907, a volume of the 'Fauna of British India' (Mollusca) has been completed and published (June 1908). It treats only of two Families, the Testacellidæ and Zonitidæ. This volume was commenced by Dr. W. T. Blanford, who wrote all the conchological portion and some of the anatomical, at which I assisted; after his death I took up what was left to be done and brought it to conclusion. The anatomical part is largely taken from the writings of Dr. F. Stoliczka and from what has been published in this work on the Indian Land Mollusca up to Part X., April 1907. The Helicidæ and other families remain to be done, but a great deal of research work has to be accomplished first, to place species in their proper families and genera. There are a large number of species to which even Family rank cannot be assigned with any certainty, only examination of the animal is conclusive; most of these have to be collected and preserved, unfortunately they come to hand very slowly.

In spite of the great facilities for the study of Natural History and the Biological courses open to young men at the present day, it is surprising there are so few Conchologists and Malacologists

in India now, compared with the number in the early fifties and sixties of the last century. The Geological Survey of India was conspicuous at that time for the number of Assistants, including its first Director, Thomas Oldham, who, beyond their own special work, were collectors of, and several of them writers on, the Vertebrates and Invertebrates, as the pages of the Journal of the Asiatic Society of Bengal show. I can recall the names of some thirty more in other branches of the service who were working at the Fauna of India at about the same period.

This retrospect reminds me that William Theobald, of the Geological Survey of India, who for many years did good work for Indian Conchology, has passed from amongst us—one whose collections, particularly those preserved in spirit from many parts of India, have greatly assisted me in bringing out this publication. Theobald died at Ilfracombe, Devon, on 31st March, 1908.

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## Subfamily Macrochlamyinæ.

### Genus Macrochlamys.

(*Continued from* Vol. II. p. 170.)

Although this genus occupies so many pages of this work, on account of the very great number of species it contains, there still remain a very large number to be noticed. The animals of many are little known, while numerous species from Assam and Burma are new, and have to be described and their affinities indicated. Species of the genus such as *Macrochlamys subjecta*, Bs. and *vesicula*, Bs., may be taken as typical of a group I shall first deal with, having a general shell character, and a smooth-shiny surface, with a similar external and internal structure of the animal. The shell of *M. subjecta* is figured from the typical locality in the Gangetic delta, Rajmahal, in order to better illustrate the difference between it and shells somewhat similar from the Eastern Frontier of India, which Geoffrey Nevill and other conchologists considered to be this species (*vide* p. 25 of the 'Hand-list'). Fortunately I have had for comparison a fine series of shells and animals collected by myself over a large extent of country, supplemented by Dr. N. Annandale sending me many species of this genus from the Indian Museum, Calcutta, particularly a good series from Cachar collected by the late Dr. Wood-Mason, and yet another valuable consignment, mostly in spirit, collected and preserved for me by Mr. F. Ede of Silchar. My best thanks are due to them for this valuable assistance, without which the results

would have been far less satisfactory. There is in fact a wealth of material to be described, not only in this genus but in others. As work proceeds eastward into the Eastern Himalaya, Assam, Burma, and the Shan States, practically unworked areas are reached, and new species multiply, in most cases of those shells which have been collected; the animals that formed them are unknown. Species of *Macrochlamys* are without exception the most difficult to determine; only those conchologists who have worked at them, know how subtle and unfixable are the shell differences, and can form any idea what labour is entailed. The animals, however, greatly assist in the determination of species; future collectors will do well to note the colour, external form and markings, and preserve the animals for dissection. I may here point out as a remarkable and unexpected instance of divergence in internal anatomy, not borne out to the same extent in the form of the shells, the two species *M. cacharica* and *M. atricolor* display in their generative organs (Vol. I. p. 117).

I would allude here to a paper in the 'Proceedings of the Malacological Society,' vol. vi. (1905), p. 319, on the extension of this genus to the island of Mauritius, founded on specimens collected there by Monsieur E. Dupont. At the time I received them I had no Indian species the shell of which was quite comparable; since then specimens sent me by Mr. F. Ede from Cachar, described further on as *M. indica*, var., are so very similar in general character that I have been led to consider the Mascarene species was possibly introduced by the agency of man from some part of the Gangetic delta.

## Genus Macrochlamys.

*Shell smooth, subglobose or subglobosely depressed; columellar margin vertical or subvertical.*

### Macrochlamys subjecta, Bs.

(*Helix*) A. M. N. H. (2) ix. 1852, p. 407; Pfr. (*Helix*) Mon. Hel. iii. 1853, p. 48: H. & T. (*Helix*) C. I. 1876, pl. 64. figs. 1, 2, 3; Nevill, Hand-l. i. 1878, p. 25.

In Faun. Brit. Ind., Mollusca (1908) p. 98, it is thus described:—

"Shell subobtectly perforate, conoidly depressed (subglobose), very thin, smooth, with a rather oily lustre above, more vitreous beneath, pale yellowish amber to yellowish tawny in colour; spire low conoidal, apex rather acute, suture impressed; whorls 6-6½, convex above, the last considerably broader, well rounded externally and beneath; aperture slightly oblique, roundly lunate, broader than high; peristome very thin, in one plane; columellar margin much curved, becoming vertical near the perforation and triangularly expanded, but very little reflected.

"Major diam. 16, min. 13, height 9 mm.

"*Hab.* Rajmahal Hills; Orissa; Cuttack (*Theobald, W. T. B.*); Ganjam.

"This species may be distinguished from its allies by its broader last whorl and larger and broader mouth."

Specimen from Rajmahal. From Dr. Annandale (Calcutta Museum collector).

*Animal.* Pale coloured, with slight coloration near the extremity of the foot which has a hooked overhanging termination. The right shell-lobe is tongue-shaped, moderately long and attenuate, the left is very small; the left dorsal lobe is in two parts, overlapping. The generative organs were in the stage of rest, although the animals were taken in July, at the height of the rains, and I had to cut up four specimens before I could get them out in a satisfactory state. There is a coiled cæcum to the penis and a well developed amatorial organ. The teeth of the radula are of usual form, the laterals evenly bicuspid; the formula:—

48 . 2 . 10 . 1 . 10 . 2 . 48
or 60 . 1 . 60.

The species is a true *Macrochlamys* in every character, and approaches *M. glauca* closer than any other form I am acquainted with. Jaw well arched with central projection.

MACROCHLAMYS SUBJECTA, Bs. (Plate CXVIII. figs. 1–1*b*, × 2·4.)

*Locality.* Rajmahal Hills, Head of Ganges Delta (*Raban*).

Shell subobtectly perforate, subglobose, very thin, dull glassy; sculpture none; colour pale ochraceous, or yellowish tawny; spire subpyramidal, moderately high, sides flat, apex rather sharp; suture well impressed; whorls 6, very closely wound towards the apex, well rounded on the periphery; aperture broadly and roundly lunate, height slightly less than the breadth, oblique; peristome thin; columellar margin subvertical, vertical near the perforation and here very slightly reflected.

Size: maj. diam. 13·75, min. 11·25; alt. axis 7·7 mm.

I figure this species from the typical locality to show how widely it differs from shells of the Eastern Frontier, considered to be identical. Geoffrey Nevill in his 'Hand-list' gives Teria Ghat in the Khasi Hills, the Naga and Dafla Hills as localities; those from Teria Ghat, and also from the Dafla Hills judging from specimens collected by me, are referable to the species *M. vesica*, described further on, p. 248.

The type in the British Museum given by R. McAndrew, Esq., who purchased Benson's collection, is exactly like this form, and although marked on the slab "Himalayas" I feel sure came really from this locality, where Benson collected so many of the first shells he described or got them from Capt. Thos. Hutton. In fact Benson's best description of this species is in the Ann. Mag. Nat. Hist. 1852, vol. ix. p. 406 (amended character), and he obtained

it when on a river journey from Calcutta upwards near Soti Durga and Rajmahal. McAndrew, probably in affixing the new labels to Benson's shells, when they were transferred to slabs, repeated and perpetuated the error in Pfeiffer's Monograph, vol. iii. p. 47, viz. "Himalaya Mountains."

Benson says: "Mantle of the animal has a long tentacula-like process which lubricates the surface of the shell to the apex."

At page 212 of J. A. S. B. vol. vii. (1838), three very distinct species are brought together under the title of *vesicula*; and Hutton, under the impression they were identical, calls attention to the very wide range of this species both in area and elevation.

1st. Species from Neemuch and Mhow=*Helix* No. 29, J. A. S. B. vol. iii. (1834) p. 521, described but not named; *mantle processes not present*. It would be very interesting to see what this is.

2nd. From N.W. Himalaya, ascending to 10,500 ft. above the sea, in profusion along the verge of the Hills at Mansir Debi and up to Hattú Peak; climbing on plants. Very probably *M. glauca* or *nuda*, if separable.

3rd. Type described by Benson from Rajmahal, on Ganges, casually referred to in J. A. S. B. vol. v. (1836) p. 357, from Patargatha and Berhampur; *has extensile tentacular processes of mantle*. This must be *M. subjecta*.

Macrochlamys vesicula, Hutton.

Bs. (Hutton MS.) (*Nanina*) J. A. S. B. vii. 1838, p. 216; ? id. (*Helix*) A. M. N. H. (2) ix. 1852, p. 406; Hutton (*Nanina*), J. A. S. B. vi. 1837, p. 931; Pfr. *Helix* (*Nanina*) Mon. Hel. i. 1837, p. 48; id. t. c. iii. 1853, p. 47; H. & T. (*Helix*) C. I. 1876, pl. 63. figs. 5, 6; Nevill, *Nanina* (*Macrochlamys*), Hand-l. i. 1878, p. 25.

Faun. Brit. Ind., Moll. (1908) p. 79.

Blanford wrote as follows (p. 80) :—

"*Hab.* Near Simla and Mussoorie up to about 10,000 feet (*Hutton*); I have also specimens from Murree. According to Benson, various shells from the plains of India (Rájmahál &c.) belong to this form, and it was upon these specimens that his description of 1852 was founded; but the typical form described in 1838 was Himalayan and apparently from Simla. Hutton also referred to *Helix vesicula* shells found by him between Mhow and Neemuch. These forms from the lowlands of Northern India require recomparison with the Himalayan type. The *Nanina* (*Macrochlamys*) *vesicula* of Nevill's Hand-list, i. p. 25, from Rájmahál and Pareshnath, is probably, as suggested, *M. lecythis*.

"*M. vesicula* is distinguished from *M. subjecta* by its lower spire, smaller last whorl, and less broad aperture, and generally by higher lustre and paler colour."

Macrochlamys vesicula, Hutton. (Plate CXXI. figs. 1, 1 *a*.)

*Locality*. Mussoorie, N.W. Himalaya (*Godwin-Austen*), *ex* collection H. F. Blanford.

Shell narrowly perforate, globosely depressed, very thin, dull surface; sculpture none, quite smooth; colour very pale horny, nearly white; spire moderately high, depressedly pyramidal, apex acuminate; suture impressed; whorls 6, rather rapidly increasing, the last expanding, well rounded at the periphery; aperture suboblique, roundly lunate, as high as broad; peristome very thin; columellar margin nearly vertical, curved.

Size: maj. diam. 12·5; min. 11·25; alt. axis 5 mm.

In 'Fauna British India' (Mollusca), 1908, p. 80, I say:—"It is possible *vesicula* of 1838 was *M. glauca*: only the collection of a good series of shells of this type from the Simla and Mussoorie Hills at different elevations can settle this point." Again at p. 140 I say:—"It is impossible now to ascertain on what shell Mr. Benson based his first description of this species; he believed it had a wide geographical range. Unfortunately, the exact locality of the shell Dr. Blanford has described is not specified, nor is it now to be found among his shells. The Murree specimens are distinct.

"The *H. vesicula* of Hutton, 1837, was certainly Himalayan; he speaks of it as occurring from Monee Marjora, on edge of the plains, to Simla and the forest of Mahasu, 10,000 feet. He and Benson gave it an even greater range, as Dr. Blanford explains, p. 80. Thus it was that in 1852, fifteen years later, we find him giving an amended description of a shell he found at Soti Durga, at head of the Gangetic Delta, under the name *H. vesicula*. The typical specimens are in the McAndrew Collection at Cambridge, and now before me, marked Himalaya; but it is not the original label, these were all destroyed, and fresh substituted by McAndrew. These shells are unmistakably from Lower Bengal, and I can see nothing to distinguish them from *M. subjecta* of Rajmahal.

"The two species from between Neemuch and Mhow, recorded by Captain Hutton as Nos. 28 & 29, J. A. S. B. 1834, pp. 520-21, and of which he gives descriptions of the animals (sufficiently good to distinguish them when some one finds them again), cannot possibly be the same as the Himalayan *H. vesicula*. Hutton, who was a very accurate observer, noticed the difference between them: he says 'they have no tentacular processes on the right side, no fleshy hook on the tail.' No. 3 *Helix* of a previous paper in same Journal, February 1834, p. 83, was a *Macrochlamys*, and is now known as *M. petrosa*: 'shell is like No. 29, but is more polished.'"

Macrochlamys sacrata, n. sp. (Plate CXXVIII. fig. 3; Plate CXXIX. fig. 4.)

*Locality*. Parasnath (*N. Annandale*).

Shell, fine perforation nearly hidden, depressedly globose, thin, shiny; sculpture quite smooth on the last whorl, on the apical

whorls there is a subdued costulate surface; colour umber-brown with an ochraceous tint; spire depressedly conoid, sides flat, apex subacuminate; suture impressed; whorls 6, very evenly increasing, the last narrow; aperture circularly ovate; peristome thin; columellar margin very weak, a very slight reflection.

Size: maj. diam. 13·0, min. 11·0; alt. axis 5·5 mm.

About a dozen specimens were collected by Dr. Annandale, they represent the same species of which Dr. Stoliczka had the animal figured from Parasnath which he named *lecythis* with a query; of this drawing I gave a copy Vol. I. Plate XIX. fig. 5. Now *Helix lecythis* was described by Benson as from the Rajmahal Hills, and although I have seen a considerable number of this type of *Macrochlamys* from that neighbourhood, none are at all like this Parasnath species. I therefore think it safe to give it a name, for it has sufficiently well marked characters to distinguish it from *M. subjecta* and *M. vesicula*, seen also in the animal. Of one soaked out, a good deal more was seen than usual. The terminal end of the foot is very dark coloured on both sides up to the mucous gland, separated by a pale line on the keel, dark also on the head. The right shell-lobe rather long and pointed. The generative organs were attenuate in the quiescent stage. The spermatophore is very long, gradually thickening to a thick rounded end. The amatorial organ has a very finely attenuate dart. (Plate CXXIX. fig. 4.)

Radula with central teeth of usual form, the marginals evenly bicuspid:

57 . 2 . 14 . 1 . 14 . 2 . 57
or 73 . 1 . 73.

Jaw with a central projection.

Macrochlamys radia, n. sp. (Plate CXXVIII. figs. 9, 9 *a*.)

*Locality*. Tandiani, near Murree (*Theobald*).

Shell globosely conoid, shiny, transparent, narrowly perforate; sculpture quite smooth, crossed by fine lines of growth, a few showing very white and defined; colour milky white, in another umber-brown; spire depressedly conoid; suture moderately impressed; whorls 6, regularly increasing, last well rounded on periphery, flatly convex above; aperture very broadly lunate, breadth greater than height, subvertical; peristome thin; columellar margin subvertical and very slightly reflected near umbilicus.

Size: maj. diam. 14·0, min. $12\frac{1}{2}$; alt. axis 7·0 mm.

Two specimens were sent me by Theobald, one of which I figure, and I have found two from Murree in Dr. W. T. Blanford's collection, the specimens he refers to on p. 80, Faun. Brit. Ind., Moll. It is exceedingly close to *M. vesicula*, of Mussoorie, but there is a difference in the higher spire and the wind of the whorls, in the Murree shell. A comparison of the animals should be made.

MACROCHLAMYS GLAUCA, Bs. (Plate CXXVIII. fig. 10, shell; Plate CXXIX. figs. 5, 5 *a*; Plate CXXXII. figs. 6, 7, animal.)

(*Helix*) *glauca*, Bs. MS.; Pfr. (*Helix*) Symb. iii. 1846, p. 65; id. *Helix* (*Nanina*) Mon. Hel. i. 1837, p. 48; H. & T. (*Helix*) C. I. 1876, pl. 63. f. 10; Nevill (*Nanina*), Hand-l. i. 1878, p. 25.
Faun. Brit. Ind., Moll. (1908) p. 80.

Blanford describes it as follows:—"Shell obtectly perforate or subperforate, conoidly subglobose, smooth, polished, whitish horny; spire low conoid, suture impressed; whorls $5\frac{1}{2}$, convex, the last broader, rounded externally and beneath; aperture subvertical, roundly lunate, broader than high; peristome thin, in one plane; columellar margin vertical above and expanded, almost closing the perforation.

"Major diam. $11\frac{1}{2}$, min. 10, height 7 mm.

"*Hab.* Western Himalayas; Almorah, Naini Tal; Mussoorie; Kotgarh near Simla.

"A smaller shell than *M. vesicula*, with a larger mouth and the perforation nearly closed."

Specimen collected by Dr. N. Annandale at Bhim Tal, Kumaon.

*Animal.* In spirit very pale coloured with some fine mottling near extremity of the foot. A small tongue-shaped right shell-lobe and a very small left shell-lobe. The left dorsal lobe in two parts distinctly separate. The generative organs (Plate CXXIX. fig. 5 *a*) are very minute; the penis is only 1·54 mm. in total length, yet the coiled cæcum is very distinctly seen; the amatorial organ is 2·1 mm. in length.

In the radula (fig. 5) the central tooth is tricuspid, the admedians bicuspid, the laterals evenly bicuspid, becoming small on the margin; the formula being:—

35 . 2 . 10 . 1 . 10 . 2 . 35
or 47 . 1 . 47.

This species has similar habits to those of *Limax*. Mr. Annandale, who collected the specimen above described, writes:—

"This morning I was interested to observe a small snail hanging vertically by a thread of slime about 15 feet long, and I notice that one little species very common on leaves in this neighbourhood frequently remains suspended in this way by a short thread proceeding from the posterior extremity of the foot. . . . ."

Shell also from Bhim Tal figured (Plate CXXVIII. fig. 10).

Size: maj. diam. 10·75, min. 9·25; alt. axis 5·5 mm.

*M. nuda*, Pfr., *vide* Faun. Brit. Ind., Moll. (1908) p. 81, is apparently the same as *M. glauca*.

MACROCHLAMYS KULUENSIS, Blf. (Plate CXXVIII. fig. 12; Plate CXXIX. fig. 7, spermatophore.)

*Macrochlamys kuluensis*, Blf. (Nevill, MS.) P. Z. S. 1904, ii. p. 442, pl. 25. fig. 5.

In Faun. Brit. Ind., Moll. (1908) p. 81, it is thus described:—

"Shell openly perforate, subumbilicate, depressedly subglobose,

thin, translucent, smooth, pale horny; spire conoidal, suture impressed; whorls $5\frac{1}{2}$, convex, the last much larger, broadly rounded at the periphery and tumid beneath; aperture oblique, roundly lunate, about as broad as high; peristome thin, in one plane, columellar margin vertical and triangularly reflected above.

"Maj. diam. 12, min. $10\frac{1}{2}$, height 7 mm.

"*Hab.* Kulu.

"This is near *M. glauca* and *M. nuda*, but distinguished by its much more open perforation and rounder mouth."

It attains a much larger size than the above. A large series (67 in number) in all stages of growth were sent home from the Indian Museum Collection, by Dr. N. Annandale, to be identified. The largest measures 15·25 × 13·25 × 7·5 mm. Only six were fully grown, 15 × 14 mm.; the usual size is 12–14 mm. major diam., a good many only reach 9 mm. Most of these are a dingy white with a thin epidermis partly lost and peeling off. Among them were six of an umber-brown colour, and these show indistinct transverse pale lines of colour on the apical whorls. Three contained the dried up animal and were put to soak, and revealed far more than I had anticipated. The animal had no markings, the mucous gland at extremity of the foot has a hooked overhanging lobe. The peripodial margin and grooves broad. The right shell-lobe moderately long, the left small. The genitalia were not in a satisfactory state to see all the detail. The male organ was only made out in one specimen, and in that the usual cæcum near the retractor muscle was not present, but it had possibly been broken off. The amatorial organ was large and thickened. Spermatophores were present in the spermatheca of two of the specimens; one I figure (Plate CXXIX. fig. 7) has a very long capsule with a flume of about same length, having a three-pointed spine near base of the capsule, and further back the edge is set with single spines at regular intervals.

The radula has teeth of the usual *Macrochlamys* type, the marginal being nearly evenly bicuspid and very small on the extreme edge, arranged:—

50 . 2 . 14 . 1 . 14 . 2 . 50
or 66 . 1 . 66.

The jaw is arched with a central projection.

Macrochlamys masoni, n. sp. (Plate CXXXI. fig. 6.)

*Locality.* Saharunpur, N.W. Provinces. Indian Museum, Calcutta, *ex* coll. J. Wood-Mason.

Shell perforate, globosely conoid, rounded below and on periphery, rather solid; sculpture none, a perfectly smooth surface; colour dull whitish; spire conic, raised, in a second specimen very much so; suture well impressed; whorls 6, regularly increasing; aperture semioval, subvertical; columellar margin suboblique, reflected close up to the umbilicus.

Size: maj. diam. 12·75, min. 11·27; alt. axis 6·0 mm., of the 2nd sp. 6·8 mm.

This shell is not at all like *M. subjecta*, having a far more globose body-whorl and smaller aperture, nor does it approach *vesicula* of Mussoorie. I cannot match it with any species in my collection.

Two specimens have been sent me from the Indian Museum, Calcutta; they represent those recorded under No. 46 of *M. subjecta* of Nevill's Hand-list, p. 25, 8 Saharunpur. There is here a large Botanical Garden, which was formed many years ago, and it is not at all unlikely these shells were collected in it. It creates a doubt as to whether they are indigenous or have been introduced with plants from some part of the East. This species should therefore be sought for again in the surrounding country between the Jumna and Ganges.

*Shell smooth; columellar margin oblique.*

Macrochlamys vesica, n. sp. (Plate CXVIII. figs. 2–2 *c* × 2·4.)

*Locality.* Teria Ghat, foot of Khasi Hills (*Godwin-Austen*).—Type, No. 494 B.M. Coll.

Shell very narrowly perforate, the perforation partly hidden, depressedly globose, rather flat at base; sculpture none; colour pale burnt-sienna; spire low, sides rather flat; apex bluntly rounded; suture impressed; whorls 5, the first 4 closely wound, the last more tumid; aperture rather narrowly lunate; peristome thin, oblique; columellar margin very oblique and slightly thickened and shortly reflected near the perforation.

Size: maj. diam. 14·25, min. 12·5; alt. axis 7·5 mm.

This is the species which for some time was ascribed to *M. subjecta* by Stoliczka and others, and is recorded by Nevill in his Hand-list, p. 25, No. 46, 5 Teria Ghat; I have seen these shells and compared them with my types. Those catalogued from Borpani and Dikrang, Dafla Hills, are also *M. vesica*; those from the Naga Hills I have not seen, they are probably the same species; the 8 from Saharunpur are another species, more close to *M. subjecta*, and described above.

The series of this species, taken at widely separated localities, differs so much, that I have thought it desirable to give descriptions of several of them. It is variation very apparent to the eye, but not easy to define in words.

Macrochlamys vesica, n. sp. (Plate CXVIII. figs. 3–3 *c*, and another specimen fig. 3 *d*.)

*Locality.* Chatak, Sylhet District, Lower Bengal (*Godwin-Austen*).—No. 493 B.M. Coll.

The specimen figured 3 *d*. Shell of a bright glassy lustre, depressedly globose, scarcely perforate; sculpture, no striation visible; colour pinkish brown when dead; spire depressed, apex rounded; suture impressed; whorls 6, convex; aperture semilunate; peristome thin; columellar margin slightly thickened, oblique.

Size: maj. diam. 13·7, min. 12·7; alt. axis 8·5 mm.

The animal when taken was thus described: Long body, light faint green, pink at the extremity of foot, at mucous gland rather truncate. Tentacles very long, the oral also and drooping. Underside of foot of a pale orange colour and of a richer tint near the mouth. Tentacles of a light neutral grey tint.

MACROCHLAMYS VESICA, n. sp. (Plate CXVIII. figs. 5–5 $c \times 2{\cdot}4$.)

*Locality.* Hengdan, Burrail Range (*Godwin-Austen*).—No. 510 B.M. Coll.

Shell depressedly conoid, umbilicated, solid, with shiny epidermis; sculpture close fine transverse lines of growth, perfectly glassy; colour pale ochre, milky white on spire; spire conoid, apex acuminate; whorls 5, sides somewhat flat, the last somewhat depressed; aperture oblique, laterally oval; peristome thin, rather sinuate above, very oblique on columellar margin and scarcely reflected.

Size: maj. diam. 14·7, min. 12·0; alt. axis 6·5 mm.

Khasi (No. 511 B.M. Coll.). This is a more solid shell, higher in the spire, and the peristome thickened.

MACROCHLAMYS VESICA, n. sp. (Plate CXX. figs. 1–1 *c*.)

*Locality.* Ainakhal, Hailakandy, Cachar (*F. J. Ede, Esq.*).—No. 1315 B.M. Coll. A large number were sent preserved in spirit.

The animal is pale ochre throughout, only on the wall of the branchial chamber were faint spots to be seen; it is also spotted sparsely with white, so is the border of the rectum, kidney, and liver-lobes (fig. 1). The right shell-lobe lies below the periphery and the shell, the left shell-lobe is long and narrow. The left dorsal lobe is in two parts, the posterior narrow and elongate.

The genitalia (figs. 1 *a* and 1 *b*) were not in the stage of full development; they are of the true *Macrochlamys* type. These characters may be noticed:—The coiled cæcum of the penis is small, few-whorled. The amatorial organ is very large, sharply bent near the point, and bluntly rounded at the distal end.

The jaw (fig. 1 *c*) is somewhat straight on the cutting-edge with a slight central projection. The marginal teeth are nearly evenly bicuspid. Formula:—

25 . 2 . 12 . 1 . 12 . 2 . 25
or 39 . 1 . 39.

*M. vesica* was also obtained over a large extent of country, represented by specimens from the following localities:—

The Lukah Valley, Jamtia Hills, No. 500 B.M. Collection (this, a single specimen, is extremely solid, fully grown, 13·5 mm. in maj. diam.). Koliaghur tila near Tezpur, Assam, No. 515 B.M. Coll. (3 sp.). The Burroi Gorge, foot of hills, Durrang, Assam,

No. 514 B.M. Coll. (6 sp.). North Cachar, No. 502 B.M. Coll. (6 sp.). Burrail Range, No. 520 B.M. Coll. (3 sp.). Dharmkal, Cachar, No. 1748 B.M. Coll. (4 sp.). Silcuri, Cachar, No. 1749 B.M. Coll. (4 sp.). Silchar, Cachar, No. 1771 B.M. Coll. (2 sp.). Nemotha Hill, No. 1753 B.M. Coll. (3 sp.). South Sylhet, No. 682 B.M. Coll. (10 sp.).

Macrochlamys vesica, var. anomala, n. (Plate CXVIII. figs. 4–4 *c*.)

*Locality*. Maosmai, near Cherra Poonjee, Khasi Hills (*Godwin-Austen*).

Shell glassy, globose, perforation almost hidden ; sculpture none ; colour ochraceous brown ; spire rather high, convex on side ; suture well adpressed ; whorls 5, those above very convex, regularly increasing, the last rounded on the periphery and somewhat swollen ; aperture oblique, rotundately oval ; peristome thin, curved on upper margin, straight below ; columellar margin very slightly thickened, oblique.

Size : maj. diam. 13·3, min. 11·8 ; alt. axis 9·5 ; alt. body-whorl 4·6 mm.

A dried up animal was soaked out, but very little could be satisfactorily seen ; the spermatophore was, however, beautifully preserved, this was figured on Plate XCIV., Part IX. Moll. Ind., fig. 2, as that of *lecythis*, Bs., *vide* Faun. Brit. Ind., Moll. p. 98, No. 142. The distinctness of the Gangetic Delta, and Eastern Bengal and Assam shells of this type had not then been noticed.

Macrochlamys vesica, var. oglei, n. (Plate CXIX. figs. 1–1 *c*, and Plate CXX. figs. 2–2 *b* ; Plate CXXII. fig. 5.)

*Locality*. Diyung Valley, Singpho Hills (*M. T. Ogle*).

Shell narrowly perforate, in other respects similar in form to typical *vesica*, somewhat smaller ; sculpture quite smooth ; colour pale ochraceous ; whorls 5 ; columellar margin oblique, slightly reflected and very nearly covering completely the umbilicus.

Size : maj. diam. 13·25, min. 12·0 ; alt. axis 5·0 mm.

Animal pale ochraceous throughout, no markings on the visceral sac of any kind ; right shell-lobe very long and narrow, left very narrow and elongate (Plate CXXII. fig. 5) ; the left dorsal lobe in two parts, both narrow.

In the genitalia (Plate CXX. fig. 2) the amatorial organ is large, cylindrical, pointed at the free end ; the male organ has a very short blunt kalc-sac in which an immature spermatophore was forming (fig. 2 *a*), the epiphallus is long, there is a short coiled cæcum to which the retractor muscle is attached on the outside edge. The spermatheca is long, swollen at the anterior end.

The formula of the radula (fig. 2 *b*) is

47 . 2 . 12 . 1 . 12 . 47
or 61 . 1 . 61.

Centre and admedians of usual form; the 13th tooth has a narrower basal plate and a small cusp low down on the outside; the 14th tooth has a cusp well below the main point; the marginals are all *evenly bicuspid*, becoming very minute on the extreme edge. Thus differing from the radula of a very similar shell, but having a striated surface, in which the marginals are very unevenly bicuspid, viz. *M. politula* (Plate CXX. fig. 3 *d*).

MACROCHLAMYS VESICA, var. (Plate CXXI. fig. 2.)

*Locality.* Nemotha Trigonometrical Station, 3,300 ft. (*J. Wood-Mason*), *ex* Indian Museum, Calcutta.

The animal in spirit was mottled green and black. The shell is quite smooth, rich amber-colour; whorls 5½, increasing very regularly, the columellar margin is subvertical.

Size: maj. diam. 15·0; alt. axis 6·0 mm.

This shell from Cachar, very close to *M. vesica*, differs materially in form from those of the typical locality, 70 miles further to the west, compare fig. 2 with those in Plate CXVIII. figs. 2, 3, 4, and 5. Absolute similarity is not to be expected over so large an area and where climatic conditions are so variable. There being only a single specimen, I have not thought it advisable in this instance to give the shell a name. It differs sufficiently from *M. vesica* to figure and briefly describe it.

MACROCHLAMYS SYLHETENSIS, n. sp. (Plate CXXIII. fig. 9, type.)

*Locality.* Southern Hills of Sylhet (*W. Chennell*).

Shell narrowly perforate, very flatly globose, subangulate on the periphery; sculpture none, a smooth glassy surface, only crossed by fine transversal lines of growth; colour dull ochraceous with a grey tint; spire low, small, apex blunt; suture impressed; whorls 5, the last rapidly increasing, and the largest, apical whorls closely wound; aperture widely and depressedly lunate, suboblique; peristome thin; columellar margin very oblique, not thickened, and a very slight reflection.

Size: maj. diam. 15·0, min. 14·0; alt. axis 6·0 mm.

Only one specimen found, but that is of so striking a form that I do not hesitate to describe it, as the species could so easily be identified when rediscovered.

MACROCHLAMYS TERMINUS, G.-A. (Plate CXXVIII. fig. 5.)

*Macrochlamys terminus*, G.-A. Moll. Ind. ii. pp. 134, 136, pl. xciv. figs. 3, 3 *a* (spermatophore) (1899).

Faun. Brit. Ind., Moll. (1908) p. 106, described as follows:—

"*Hab.* Brahmakund, Eastern Assam; Singpho; Naga and N. Cachar Hills.

"Shell perforate, depressed, thin, smooth, polished; spire very

low, convexly conoidal, apex obtuse, suture scarcely impressed, shallow; whorls 6, flatly convex above, the last broader, rounded at the periphery, convex beneath; aperture subvertical, broadly and ovately lunate, margins converging; peristome thin, the basal margin slightly arcuate, columellar margin vertical for a short distance above, and reflected, then curved and oblique, slightly expanded.

"Size: maj. diam. $12\frac{1}{2}$, min. $11\frac{1}{2}$, height 6·0 mm."

The type shell is figured from Brahmakund on the Lohit River.

Macrochlamys extraria, n. sp. (Plate CXXVIII. fig. 4.)

*Locality.* North-East Munipur (*W. Ogle*).

Shell narrowly perforate, thin, polished, very flatly conoid; sculpture none, quite smooth; colour dull burnt-sienna; spire flatly conoid, low, sides flat; suture impressed; whorls $5\frac{1}{2}$, regularly increasing; aperture lunate, width greater than length, subvertical; peristome thin; columellar margin rather solid, not reflected, oblique.

Size: maj. diam. 12·0, min. 10·5; alt. axis 4·75 mm.

This is a close ally of *M. terminus*, but is far flatter, both above and below. I have a good series of ten all alike.

Macrochlamys uda, G.-A. (Plate CXXVIII. figs. 13, 13*a*.)

*Macrochlamys uda*, G.-A. Moll. Ind. ii. p. 136, pl. xciv. fig. 1 (spermatophore).

Faun. Brit. Ind., Moll. (1908), p. 104.

*Locality.* Hengdan Peak, Burrail Range, Assam (*Godwin-Austen*).

The type shell was found on this peak and was described in Vol. II. p. 136, but it was never figured, and this I now do. Besides the localities previously mentioned, I have specimens from Phunggam and Gaziphima in the Lahupa Naga Hills, rather more openly umbilicated. The dwarf variety mentioned at p. 136, of which I now figure a specimen (Plate CXXXI. figs. 10, 10 *a*), has a very thickened lower margin and is exceptional. It was from Phunggam in the Lahupa Naga Hills, N.E. Munipur.

Macrochlamys kurtzi, n. sp. (Plate CXXI. figs. 4, 4 *a*.)

*Locality.* Arakan (*S. Kurtz*), in Coll. Indian Museum, Calcutta, No. M. $\frac{3662}{1}$. *Vide* Nevill's Hand-list, i. 1878, p. 24, first recorded under var. *andersonii*, G. Nev.

Shell very globosely depressed, perforate; sculpture, apparently quite smooth; colour, specimen bleached; spire low, sides flat, apex blunt; suture impressed; whorls 5, regularly increasing, the last somewhat tumid, well-rounded on the periphery, descending at the aperture; aperture semiovate, oblique; peristome thin, in the figure a fresh growth of shell is indicated; columellar margin very oblique and slightly reflected near the umbilicus.

This is a single specimen, but as its form is very different from any other in this particular group of *Macrochlamys*, I am induced to give it a name. It comes apparently nearest to *M. rabani* of Chittagong, but in that shell the columella is not so oblique and the last whorl does not descend at all at the aperture.

MACROCHLAMYS CACHARICA, var. GLAUCA. (Plate CXXI. fig. 5.)

*Locality.* Borpani, foot of Dafla Hills (*Godwin-Austen*).

The type is described in Vol. I. p. 118, and the figure (Plate XXIV. fig. 6) is that of a full-grown specimen. From the Burroi Gorge, base of Dafla Hills, I have smaller examples, the largest 16·5 mm. in major diameter. The shell now figured is from the Indian Museum, Calcutta, collected by me, and bears the MS. name of *M. omphaloides*, Nevill. There are a number in all stages of growth, and the one figured is only 14·0 mm. in maj. diam.

I may here explain why the above MS. name is alluded to. On my return from the Dafla Expedition, I placed the greater part of the Zonitidæ in Geoffrey Nevill's hands for him to work out; unfortunately he was not spared to complete the task, and now a number of these species come back to my hands through Mr. N. Annandale. As it is possible the unpublished names of these shells have spread to private collections, it may save trouble to mention them.

*omphaloides* appears in the Hand-list, Nevill's copy, p. 25, 8 lines from top, var. of *Nanina ramriensis*, Blf., " 12 Borpani, coll. Major H. H. Godwin-Austen." The animal of *cacharica* var. *glauca* has never been examined, and should the anatomy prove unlike that shown on Plate XXVII. (Vol. I.) fig. 2 *c* of *M. cacharica*, G. Nevill's name should be adopted in preference to *glauca*.

MACROCHLAMYS CINCTULA, Nevill MS., n. sp. Type var. (Plate CXXI. fig. 9.)

Nevill's Hand-list, i. 1878, p. 24, under No. 34, *Nanina* (*Macrochlamys*) *honesta*, Gould, var. nov. Not allied to this last-named species.

*Locality.* Dounggying, Burma (*R. Hungerford*).

Shell closely perforate; sculpture none, finely streaked transversely by the lines of growth; colour ?, specimen bleached; spire flatly pyramidal; apex blunt; suture impressed; whorls 5, flattened, rounded on the periphery; aperture broadly lunate; peristome somewhat thickened below; columellar margin very oblique, reflected close to umbilicus.

Size: maj. diam. 13·5; alt. axis 6·0 mm.

This shell is of the type of *M. vesica* in general form and the very oblique columellar margin, but placed side by side there are minor differences. Only one specimen was in the tube sent, which goes back to the Indian Museum, Calcutta.

*Shell smooth, glassy; columellar margin vertical or subvertical. Small, about* 10–12 *mm. in major diameter.*

Macrochlamys andersoniana, Nevill. (Plate CXIX. figs. 10, 10 *a*–10 *c*; Plate CXXI. figs. 11, 11 *a*.) Type.

*Nanina honesta*, var. *andersoniana*, Nevill, J. A. S. B. 1877, 2, p. 16; id. Yunnan Exped., Moll. 1879, p. 874.

*Nanina (Macrochlamys) honesta*, var. *andersoni*, Reeve, Conch. Ic. pl. 84. fig. 452 (as *Helix honesta*); Nevill, Hand-list, i. 1878, p. 24.

Faun. Brit. Ind., Moll. (1908) p. 141.

*Original description*:—"This variety is distinguished (from typical *honesta*) by its less depressed shape, it is scarcely if at all angled at the periphery (the angulation being very distinct in the type form), the peristome not being so broadly reflected over the perforation; the substance and texture, perforation, shape of the aperture, and number of whorls are identical."

Type of var. *andersoniana* from Ponsee (*J. Anderson*), Plate CXXI., is in the Indian Museum, Calcutta.

Diam. 11, axis $6\frac{1}{4}$; apert. alt. 4, diam. $5\frac{1}{2}$ mm.

Nevill records: *Hab.* Thyetmyo, Sibsagur, Naga and Khasi Hills, Chittagong and East Cachar, Dafla Hills, &c. I can only accept his Upper Burma localities: Pudupyoe, 2nd Defile Irrawady, Nandin, and Ava. Specimens from Bhamo (*Anderson*) in my collection do not agree with the Assam shells, and I doubt the identification, many of the shells having been collected by and known to me. The description of the Bhamo shell (Plate CXIX.) is as follows:—

Shell globosely and depressedly conoid, narrowly umbilicated, rather solid; sculpture very smooth and glassy, longitudinal microstriation; colour pale horny with a greenish tinge; spire moderately high, slightly convex; suture adpressed; whorls $4\frac{1}{2}$, sides above convex and well rounded on the periphery, the last slightly descending; aperture oblique, broadly lunate; peristome slightly thickened, straight, reflected considerably over the perforation.

Size: maj. diam. 10·3, min. 8·5; alt. axis 5·0, alt. body-whorl 4·0 mm.

Having examined the animal of *M. honesta* from Mulé-it, Tenasserim, I have found considerable differences between it and *M. andersoniana*, especially in the radula; this last I consider a good species. It was apparently this species, or one very like it, which Stoliczka described in the Journ. Asiat. Soc. Bengal, 1871, at the bottom of pp. 249–250, with the figures on pl. xvii. of teeth of the radula, fig. 14, and the spermatophore, fig. 13.

Macrochlamys andersoniana, Nevill. Type. (Plate CXXI. figs. 11, 11 *a*.)

*Nanina honesta*, var. *andersoniana*, Nevill, J. A. S. B. 1877, 2, p. 16; id. Yunnan Exped., Moll. 1879, p. 874.

Nevill's Hand-list, i. 1878, p. 24, var. *andersoni*, G. Nevill (type var., ten specimens).

*Locality*. Ponsee, Yunnan (*Dr. J. Anderson*).

All the shells enumerated under No. 43, *Nanina* (*Macrochlamys*) *honesta*, Gould, of the Hand-list, p. 24, have been kindly sent me for examination by Mr. N. Annandale, Superintendent of the Indian Museum. Thus I have been able to figure this type species and determine many of the specimens from numerous localities.

Macrochlamys sufflava, n. sp. Type. (Plate CXIX. 1st sp. fig. 4, 2nd sp. fig. 5 (shells).) No. 517 B.M. Coll. (Plate CXXII. figs. 1–1 *c*, anatomy.)

*Locality*. Lhota Naga Hills (*W. Chennell*).

Shell subglobosely turbinate, glassy; sculpture very smooth, with a few longitudinal and very indistinct microstriæ, practically none, only to be seen with high power and strong light; colour pale horny-brown, or pale ochraceous; spire depressedly conoid; apex blunt; suture impressed; whorls 5, regularly increasing, the last rounded on the periphery; aperture semilunate; peristome thin; columellar margin oblique.

Size: maj. diam. 10·5, min. 9·5; alt. axis 5·5 mm.

*Animal*. Dark on the extremity of the foot; shell-lobes as in *M. atricolor*.

The generative organs were got out in a very perfect state and mounted. The male organ is small in comparison to the other organs, has the coiled cæcum to which the retractor muscle is attached, but with a very small kalc-sac, in fact it hardly seems in the full matured form. The spermatheca on the other hand was large and long and contained a perfect spermatophore, the flume of which had long bifid spines (fig. 1*a*) on one side, also near the base of the capsule (fig. 1*c*), the last being much larger and stronger. The head of the capsule (fig. 1*b*) is blunt, terminating in a long tube, the part formed within the vas deferens of the animal with which this one was *in coitu*. The amatorial organ is long and large.

Plate CXIX. fig. 3. A typical shell, North Cachar: animal dissected and radula mounted. No. 509 B.M. Coll.

Macrochlamys sufflava, n. sp. (Plate CXIX. figs. 7, 7*a* (shells), and Plate CXXII. fig. 3 (spermatophore).) No. 503 B.M. Coll. (Plate CXXIX. fig. 8, radula.)

*Locality*. Lhota Naga Hills (*W. Chennell*).

Shell subdepressedly conoid, rather solid, flat below; sculpture fine, close, transverse lines of growth; colour pale umber or

corneous; spire moderately high, apex rounded; suture adpressed, well defined; whorls 6, closely and regularly wound, the last rounded, not swollen below; aperture lunate, suboblique; peristome thin, sinuate both on upper and lower margin, very obliquely descending on the columellar margin, but slightly reflected yet covering completely the umbilicus.

| | mm. | | mm. | | mm. |
|---|---|---|---|---|---|
| Size: maj. diam.... | 11·5 | min. diam. | 10·5 | alt. axis .. | 5·0 |
| alt. body-whorl | 4·0 | alt. ap. .. | 5·0 | diam. ap... | 6·0 |

Mr. Chennell collected a number of this species in the above Hills. Though very like at first glance to young *M. atricolor*, its more closely wound whorls distinguish it at once.

The animal of this specimen was dissected. The right shell-lobe was rather short and tongue-shaped, and there was the usual small left shell-lobe. A spermatophore (Plate CXXII. fig. 3) was in a good state of preservation. It has a long flume, with elongate spines on one side only, each terminating in a bifid point; they only extend about halfway towards the capsule, close to this are four thicker spines set close together.

The radula (Plate CXXIX. fig. 8) has long pointed centrals of usual form, cusps on outer margin, basal two transitional teeth very much narrower, the admedians evenly bicuspid, arranged

56 . 2 . 10 . 1 . 10 . 2 . 56

or 68 . 1 . 68

in 110 rows. Jaw has a central projection.

MACROCHLAMYS SUFFLAVA, n. sp. (Plate CXIX. fig. 9, shell; Plate CXXII. figs. 2–2 *c*, anatomy.)

*Locality*. Eastern Burrail Range (*Godwin-Austen*). No. 519 B.M. Coll.

*Animal*. Has a small tongue-shaped right shell-lobe. The genitalia (fig. 2) are on the plan of typical *Macrochlamys*, the male organ having a small coiled cæcum near the retractor muscle attachment (figs. 2 *a* and 2 *b*). Amatorial organ large. Jaw has a central projection (fig. 2 *c*), and is well arched above.

MACROCHLAMYS SUFFLAVA, n. sp. (Dissected, shell not drawn.)

*Locality*. Lhota Naga Hills (*W. Chennell*). No. 523 B.M. Coll.

Shell umbilicated, globosely conoid, thin, transparent, glassy; sculpture none, surface quite smooth; colour pale greenish horny; spire rather high, apex blunt; suture impressed; whorls 5, the last well rounded and swollen below; aperture rotundately oval, subvertical; peristome thin, straight, subvertical on inner margin, but slightly reflected.

Size: maj. diam. 10·5, min. 9·75; alt. axis 5·0 mm.

Macrochlamys sufflava, n. sp. (Plate CXXII. fig. 4, radula.)

*Locality.* Hengdan, North Cachar (*Godwin-Austen*). No. 509 B.M. Coll.

A typical specimen from this locality was dissected; the radula was very perfect (fig. 4). Teeth arranged:—

54 . 2 . 10 . 1 . 10 . 2 . 54
or 66 . 1 . 66.

The admedians of usual shape; the laterals evenly bicuspid, becoming minute on the extreme edge.

Plate CXIX. fig. 6. Shell, Burrail Range.

Macrochlamys lubricata, n. sp. (Plate CXXI. fig. 10; Plate CXXIX. figs. 6, 6*a*, animal.)

*Locality.* Silchar, Cachar (*F. G. Ede*). No. 989 B.M. Coll. Type.

Shell smooth, polished, turbinately globose; sculpture none; colour pale burnt sienna-brown; spire moderately raised; suture shallow; whorls 5; aperture semilunate, circular on outer margin; peristome thin; columellar margin very slightly oblique.

Size: maj. diam. 12·0, min. 10·5; alt. axis 5·5 mm.

*Animal.* White throughout in the spirit specimen, no markings of any kind. When the shell is removed the visceral sac is ochraceous with white specklings on the apical portion. *The right shell-lobe is extremely long as also the left.* The end of the foot rather truncate, the part above the mucous gland small. The radula has the formula

62 . 11 . 1 . 11 . 62
or 73 . 1 . 73.

In specimen dissected the generative organs were not developed and could not be made out.

There were also sent me by Mr. Ede, five specimens in spirit which had evaporated and left them quite hard; in these the foot was long with a small hook-like lobe. The radula was

50 . 2 . 9 . 1 . 9 . 2 . 50
or 61 . 1 . 61.

Macrochlamys lubricata, n. sp. (Plate CXIX. figs. 11, 11 *a*, 11 *b*.) No. 522 B.M. Coll., two specimens not fully grown.

*Locality.* Naga Hills, Burrail Range (*Godwin-Austen*).

Shell tumidly conoid, thin, diaphanous; sculpture none, surface as in the type; colour pale horny-brown; spire rather high, convex, apex blunt; suture adpressed, well marked; whorls 4½, concave, the last rapidly increasing and ventricose below; aperture roundly lunate, oblique; peristome thin, straight, nearly vertical on columellar margin, reflected near umbilicus but not covering it.

| | | | | | |
|---|---|---|---|---|---|
| | mm. | | mm. | | mm. |
| Size: maj. diam. .. | 10·0 | min. diam. | 8·5 | alt. axis .. | 4·8 |
| alt. body-whorl | 4·3 | alt. ap. .. | 5·5 | diam. ap. | 5·6 |

Shell and dorsal lobes as in typical *Macrochlamys*, the right shell-lobe being long and pointed and the left a small tongue-like process. The generative organs were not well preserved, but the amatorial organ was present and the other organs of usual form, the coiled cæcum of the penis being small.

The species was also obtained at Teria Ghat, two examples; from the Lhota Naga Hills, one; and from Piknui in the Lahupa Naga Hills, two.

The preceding eight species are very closely allied and similar in shell-character. The living animals require examination, and far better material for dissection is required than I had to deal with.

Plate CXIX. fig. 8. Shell nearest to *M. lubricata*. Lhota Naga Hills.

Macrochlamys rabani, n. sp. (Plate CXXI. fig. 6.)

*Locality*. Chittagong (*H. Raban*). Indian Museum, Calcutta, No. 3663.—Nevill, Hand-list, i. p. 24, as a var. of *honesta* under var. *andersoni*, G. Nev., 2nd specimen recorded.

Shell subdepressedly globose, openly perforate; sculpture none, surface smooth, glassy, near aperture in high light close-set transverse lines of growth visible; colour milky-white or pale ochraceous; spire low, sides flat, apex blunt; suture rather shallow; whorls 5, regularly increasing, well rounded on the periphery; aperture semilunate; peristome thin; columellar margin suboblique, thickened, and shortly reflected near umbilicus.

Size: maj. diam. 13·0; alt. axis 4·0; largest specimen maj. diam. 14·25 mm.

Macrochlamys garoensis, n. sp. (Plate CXXI. fig. 3.)

*Locality*. Garo Hills, south base of (*Godwin-Austen*).

Shell depressedly globosely conoid, somewhat flat on the base; sculpture none, surface smooth and rather shiny; colour umber-brown; spire flat-sided, depressedly conoid; suture moderately impressed; whorls 5, regularly increasing; aperture broadly lunate; peristome thin; columellar margin oblique, not thickened, and only reflected close to the umbilicus.

Size: maj. diam. 11·7, min. 10·0; alt. axis 5·3; largest specimen maj. diam. 12·25 mm.

There are four specimens in my collection, the largest is a dead shell bleached.

Macrochlamys? proba, n. sp. (Plate CXXI. fig. 7.)

*Locality*. Thyetmyo, Pegu (*Theobald* or *Blanford*). Indian Museum, Calcutta, No. 3676 *c*.

This shell is one of the ten recorded in Nevill's Hand-list, i. (1878) No. 43, p. 24, as *Nanina* (*Macrochlamys*) *honesta*, Gould. There were three species in the same tube, respectively *M. chaos*, W. T. Blf., 7 specimens; *M. fidus*, n. sp., 2 specimens; and the one under review, a very distinguishable form.

Shell very depressedly conoid, subangulate on the periphery, very narrowly perforate, thin and fragile; sculpture quite smooth; colour milky-white; spire moderately elevated, apex blunt; suture moderately impressed; whorls $4\frac{1}{2}$, regularly increasing; aperture narrowly quadrately lunate; peristome thin; columellar margin suboblique.

Size: maj. diam. 12·75, min. 11·0; alt. axis 5·25 mm.

*Mostly smooth, membranaceous.*

Placed in *Macrochlamys* provisionally, some on dissection of the animal may prove to belong to *Cryptaustenia.*

MACROCHLAMYS BILINEATA, G.-A. (Plate CXXVI. fig. 9.)

*Macrochlamys bilineata*, G.-A., J. A. S. B. 1876, 2, p. 311, pl. 8. fig. 9.

Faun. Brit. Ind., Moll. (1908), p. 103.

*Locality.* Tanir Lampa ridge, 4000 ft.; Dafla Hills, North Assam.

*Description of the animal*:—"The foot pale ochraceous; tentacles black, the black extending on to the neck as two very conspicuous, well-defined, parallel lines; the upper part of the foot has also two parallel black lines. From the right anterior margin a long tongue-like process is given off which reaches, when fully extended, up to the apex of the shell."

Size of a large shell: maj. diam. 13, min. 11; alt. axis 6·5 mm.

Very abundant in the forest among the fallen leaves.

*Original description*:—"Shell globose, very shiny, transparent, greenish yellow; whorls 5, spire conoid. The living shell appears mottled on the upper surface with black and white, from the body of the animal shining through its thin transparent walls."

MACROCHLAMYS? LAHUPAENSIS, G.-A. (Plate CXXVI. figs. 3, 3 *a*.)

*Macrochlamys lahupaensis*, Moll. Ind. ii. 1907, p. 159.

Faun. Brit. Ind., Moll. (1908), p. 109.

MACROCHLAMYS? SUBANGULATA, n. sp. (Plate CXXVI. fig. 4.)

Very near *lahupaensis*, G.-A.

*Locality.* Burrail Range (*Godwin-Austen*).

Shell globosely turbinate, tumid, thin, transparent, very narrowly umbilicated; sculpture none, surface quite smooth, crossed transversely by regular undulations of growth; colour pale straw; spire elevated, sides slightly concave, apex sharp; suture impressed; whorls 5, *the last with just a slight indication of a keel*; aperture rotundately oval, nearly vertical; peristome very thin; columellar margin perpendicular, not thickened, and just reflected near umbilicus.

Size: maj. diam. 12·0, min. 10·0; alt. axis 6·0 mm.

This shell is extremely close to *M. lahupaensis*, only differing in the form of the last whorl; the habitat is about 30 miles apart.

MACROCHLAMYS? MUNIPURENSIS, G.-A. (Plate CXXVI. fig. 8.)

*Macrochlamys munipurensis*, Moll. Ind. ii. 1907, p. 158.
Faun. Brit. Ind., Moll. (1908), p. 107.

MACROCHLAMYS? SCYPHUS, n. sp. (Plate CXXVI. figs. 1, 1 *a*.)

*Locality.* Teria Ghat, base of Khasi Hills (*G.-A.*).

Shell globosely conoid, imperforate, thin, semitransparent and membranaceous; sculpture smooth, with close transverse lines of growth, slight indication of spiral striæ near the suture of last whorl; colour ochraceous with a slight green tint, the second specimen is of a darker tint of green; spire moderately high; suture very impressed; whorls 4, rapidly increasing, the last very large and tumid; aperture rather more than semilunate; peristome thin; columellar margin not thickened, with a very slight reflection.

Size: maj. diam. 11·75, min. 10·75; alt. axis 5·0 mm.

This is a very distinct form from this locality. I believe it to be the shell referred to by Mr. Benson when he described *Vitrina scutella* in the Ann. & Mag. Nat. Hist. March 1859: "Of this species the larger example from Kashmir was first sent by Mr. Theobald, and subsequently another specimen, obtained by him at Teria Ghat, was received. The membranaceous nature of the shell might on a casual glance lead to the impression that the two shells were one and the same species."

There are two specimens in my collection, and I have seen one in that of Mr. G. K. Gude, from Cherra Poonjee.

MACROCHLAMYS EVIDENS, n. sp. (Plate CXXVI. fig. 11.)

*Locality.* Darjiling (ex coll. *Godwin-Austen.* Type).

Shell subdepressedly globose, scarcely perforate, thin and fragile; sculpture wavy lines of growth only, smooth and shiny; colour pale straw with a slight greenish tinge; spire depressedly conoid, blunt; suture impressed; whorls 4, convex, ample, increasing regularly; aperture subvertical, broadly lunate, arcuately descending; peristome thin; columellar margin feeble, not reflected.

Size: maj. diam. 10·75, min. 9·5; alt. axis 4·5 mm.

Four of this species were sent to me by Mr. Annandale from the Calcutta Museum series, and are the specimens recorded in Nevill's Hand-list, p. 26, No. 59. "*Nanina* sp., 20 Darjiling, coll. Dr. F. Stoliczka and Colonel G. Mainwaring."

Macrochlamys ? striata, n. sp. (Plate CXXVI. fig. 10.)

*Locality.* Silcuri, Cachar (*Wood-Mason*).

Shell subperforate, globose; sculpture none, smooth, polished, with regular lines of growth, showing alternately pale and dark coloured; colour rich umber-brown; spire low, apex flatly rounded; suture shallow; whorls 4, rapidly increasing, the last expanded, rounded on periphery; aperture widely lunate; peristome thin, not thickened at all at the columellar margin.

Size: maj. diam. 12·25, min. 11·0; alt. axis 5·5 mm.

Two specimens were found.

Macrochlamys ? japvoensis, n. sp. (Plate CXXVI. fig. 5.)

*Locality.* Japvo Peak, Anghami Naga Hills, 10,000 ft. (*G.-A.*).

Shell scarcely perforate, depressedly globose, base rather flat, thin and membranaceous: sculpture none, polished, streaked transversely, particularly below, with lines of growth; colour olivaceous green; spire moderately elevated, apex blunt; suture very shallow; whorls 5, the last well-rounded on the periphery, rather rapidly increasing; aperture semi-lunate; peristome thickened; columellar margin suboblique, not reflected at all.

Size: maj. diam. 10·25; alt. axis 0·4 mm.

Of this very interesting species I only obtained two specimens. From the thickened peristome, with feeble columella, and its transparent membranaceous shell, it might belong to the genus *Cryptaustenia*, but as the animal is unknown I place it in *Macrochlamys*.

Macrochlamys ? nemothaensis, n. sp. (Plate CXXVI. fig. 7.)

*Locality.* Nemotha Peak, Trigonometrical Station near Silchar, Cachar (*J. Wood-Mason*).

Shell globosely turbinate, thin, imperforate; sculpture none, surface shining; colour a rich ochre with a greenish tinge; spire subpyramidal, apex rather pointed; suture impressed; whorls 5, regularly increasing; aperture lunate, as broad as high, subvertical; peristome thin; columellar margin nearly vertical, then becoming oblique, neither thickened nor reflected.

Size: maj. diam. 10·75, min. 10·0; alt. axis 5·5 mm.

There are numerous examples of this shell, provisionally named *M. seposita*, Bs., in Calcutta; it cannot, however, be that species which is from Darjiling and has 3 whorls only according to Benson's description. It approaches *M. razamiensis*, G.-A., but apex is not the same. It may possibly turn out to be *Nanina* (*Medyla*) *salmonea*, Ancey, Le Nat. ii. p. 119 (1882), from its coloration, number of whorls, and general form.

Macrochlamys ? saltus, n. sp. (Plate CXXVI. figs. 2, 2 *a*.)

*Locality.* Moyong, N.W. Khasi Hills (*Godwin-Austen*).

Shell globosely conoid, imperforate, very thin, transparent,

shiny; sculpture none; colour pale sap-green; spire depressedly conoid; suture shallow; whorls 4, the last large and tumid, rather rapidly increasing; aperture widely lunate, subvertical; peristome very thin; columellar margin very oblique, neither thickened nor reflected.

Size: maj. diam. 9·25, min. 7·75; alt. axis 5·0 mm.

This shell is extremely close to *M. razamiensis* of the Naga Hills, some 150 miles further east; placed side by side, the difference of form in the more tumid shell and closer wound whorls of *razamiensis* is at once apparent, *vide* Pl. CVIII. figs. 2–2 *b*. Only two specimens found. Animal not seen.

Macrochlamys? sphærica, n. sp. (Plate CXXVI. figs. 6, 6*a*.)

*Locality*. Nongsingriang Wood, N.W. Khasi (*Godwin-Austen*).

Shell globularly conoid, imperforate, covered with a dark-coloured membranaceous epidermis; sculpture none; colour bleached, quite an old shell; spire very low, apex rounded; suture very shallow; whorls 4, rapidly increasing, the last very ample, flattened above; aperture roundly lunate, quite circular on the periphery, subvertical; peristome very thin; columellar margin perpendicular, long.

Size: maj. diam. 10, min. 8; alt. axis 4·8 mm.

Only one specimen was obtained, its globular form distinguishes it at once from another membranaceous shell living in the same wood. In Mr. G. K. Gude's collection, I have seen a shell from Cherra Poonjee of a pale liver-colour, with bright shining surface, which is of similar form to *sphærica*. The spire is not normal; there are the same number of whorls, but the second is extremely narrow having been overgrown by the third, giving the spire a very contracted appearance.

Macrochlamys? herbia, n. sp. (Plate CXXIII. figs. 2, 2 *a*.)

*Locality*. Naga Hills (*Godwin-Austen*).

Shell depressedly globose, closely umbilicated, rather flat on base, very thin and membranaceous; sculpture none; colour dull green; spire low, apex blunt; suture moderately impressed; whorls 5, closely wound near apex, then increasing in size; aperture broadly lunate, suboblique; columellar margin suboblique, slightly thickened, not reflected.

Size, largest: maj. diam. 9·5, min. 8·5; alt. axis 4·0 mm.
Spec. figured ,, 9·0, ,, 4·0 ,,

Macrochlamys? vertex, n. sp. (Plate CXXIII. fig. 6.)

*Locality*. Japvo Peak, Anghami-Naga Hills, 10,000 ft. (*Godwin-Austen*).

Shell subdepressedly globose, imperforate, membranaceous, somewhat transparent; *indistinct longitudinal sculpture*, glassy; colour dark sap-green; spire very low, apex rounded; suture

rather deep; whorls $3\frac{1}{2}$, the last very tumid and rounded on the periphery; aperture broadly lunate, oblique; peristome thin; columellar margin perpendicular, not thickened, and scarcely reflected.

Size: maj. diam. 7·5, min. 6·75; alt. axis 3·0 mm.

Only one specimen obtained. The Peak is covered with the densest forest.

MACROCHLAMYS? PROPINQUA, n. sp. (Plate CXXIII. figs. 3, 3*a*.)

*Locality.* Komamedza, Naga Hills (*Godwin-Austen*).

Shell imperforate, globosely pyramidal, thin, very transparent, membranaceous; sculpture beautifully, *finely and regularly striate longitudinally,* crossed with regular furrows of growth; colour very pale straw; spire moderately high, apex rounded; suture shallow; whorls $4\frac{1}{2}$, rather rapidly increasing; aperture semilunate; columellar margin oblique, not thickened.

Size: maj. diam. 6·5; alt. axis 3·2 mm.

Only one specimen found, but it is very distinct from other species of this group known to me.

MACROCHLAMYS? QUÆSITA, n. sp. Type. (Plate CXIX. figs. 12, 12 *a*, 12 *b*.) No. 240 B.M. Coll.

*Locality.* Burrail Range, Naga Hills, Assam (*Godwin-Austen*).

Shell depressedly globose, very narrowly perforate; sculpture none, dull surface; colour pale ochraceous; spire low; suture adpressed; whorls $4\frac{1}{2}$, closely wound at apex, increasing rather rapidly; aperture lunate, descending slightly; peristome thin; columellar margin suboblique, very slightly reflected.

Size: maj. diam. 11·5, min. 10·5; alt. axis 5 mm.

This species recalls *M. moyongensis*, but the form is more globose and the columellar margin more oblique. It is represented by four specimens.

MACROCHLAMYS BEATA, G.-A. (Plate CXXV. figs. 6–6 *c*.)

Moll. Ind. vol. ii. p. 156, pl. cviii. figs. 1–1 *b* (shell).
Faun. Brit. Ind., Moll. p. 107.

Shell with a very flat rounded apex was figured on Plate CVIII. I now give figure of one with a higher spire, also of the animal (figs. 6 *b*, 6 *c*) which was soaked out and was in a very good state of preservation. It is very dark in colour, the sole of the foot paler. The lobe above mucous pore small. The right shell-lobe is triangular, the base resting on the right dorsal lobe from the upper inner angle of the aperture downwards. The left shell-lobe is long and oblong in shape. Generative organs not preserved.

*Shell depressed or conoidly depressed.*

*With longitudinal striation.*

MACROCHLAMYS INDICA, var. (Plate CXXXI. fig. 3; Plate CXXXII. figs. 9–9 *d*.)

*Locality*. Silchar, Cachar (*F. Ede*). No. 968 B.M. Coll.

Shell depressedly conoid, narrowly perforate; sculpture coarse, wavy, distant striation, like that of fig. 1, Plate XXI., *M. indica*; colour rich umber-brown, or pale burnt-sienna; spire low, sides flat, apex flatly conoid; suture shallow; whorls 6, regularly increasing, the last well rounded; aperture semilunate, subvertical; peristome thin; columellar margin oblique, not thickened, just reflected close to the umbilicus.

| | | | | |
|---|---|---|---|---|
| Size .... | Maj. diam. 18·0, | min. 16·0; | alt. axis 7·0 mm. |
| Largest.. | „ 23·0, | „ 21·5; | „ 9·5 „ |

This no doubt represents, in this part of the N.E. Frontier, the Calcutta form of *M. indica*, only that here it grows to a much larger size. For comparison, the one I have selected to figure is of the same size, and it will be seen is somewhat flatter on the spire, but the aperture is quite similar, and the sculpture at once distinguishes the species.

This species is found also at Bolagunj, Sylhet, where its form is quite that of Calcutta shells, and of same size. These shells were obtained by Mr. Wood-Mason, and Nevill had named them *pseudovitrinoides*—a MS. name—which may have got into some collections *.

The generative organs also agree with those I figured and described in Vol. I. p. 98, Plate XVIII. figs. 2 and 3. I give figures of them in order to verify former work.

The radula showed a formula of :—

20 . 1 . 10 . 1 . 10 . 1 . 20

or 31 . 1 . 31

a reduction of the marginals only.

Jaw with central projection.

*Animal*. There is a narrow black band near the mantle-edge, and the wall of the branchial cavity is bordered by a narrow black band running back as far as the heart. Whether this is to be seen in Calcutta specimens is a point to be observed.

*Very fine microscopic striæ.*

MACROCHLAMYS HARDWICKEI, type—Moll. Ind. i. 1883, pp. 105–107.

Faun. Brit. Ind., Moll. (1908) p. 97.

* It is, I know, not desirable to publish MS. names, but Nevill made exchanges with both British and Foreign collectors, and many of these names have become known to them.

Macrochlamys politula, G.-A. (Plate CXX. figs. 3–3 *d*.)

*Locality.* Diyung Valley, Singpho Hills. No. 2087 B.M. Coll.

The two specimens now referred to, neither fully grown, were obtained by Mr. M. Ogle. The species was described in Vol. I. p. 107, Plate XXIII. fig. 3, as a variety of *M. hardwickei*. It was from Upper Assam, also from Brahmakund on the Lohit Brahmaputra River. The two specimens on page 107, under *hardwickei* var., I consider should be included. The animal was not then known. The two specimens were found together with *M. vesica* and preserved in alcohol; the very different coloration of the animals distinguish them at once, *M. vesica* being of the same colour throughout with no markings.

*Animal.* A black quadrangular patch near the rectum (fig. 3), which is bordered for a long distance with large spots of same colour, with another series in the middle line of the branchial wall, up to and as far as the kidney, sparsely and finely spotted on the left side of the visceral sac (fig. 3 *a*). Right shell-lobe (fig. 3) moderately long, broad at base, given off from the right dorsal lobe. The left shell-lobe (fig. 3 *a*) very narrow and small, rising from a broad triangular base. The left dorsal lobe is in two distinct parts, the posterior elongate narrow with free ends.

The generative organs (fig. 3 *b*) are of the true *Macrochlamys* type, but differ from those of *M. hardwickei* in the form of the penis, the kalc-sac of which is *quite short*, and there is a distinct terminal knob at the anterior end. The principal difference in the genitalia of *M. politula*, compared with that of *M. hardwickei* of Calcutta, is that the kalc-sac of the penis is very short in the former, while it is unusually long in the latter (*vide* Plate XXVIII. Vol. I. figs. 1 *a*, 1 *b*). The amatorial organ is long, cylindrical, gradually tapering into a long retractor muscle, the anterior end bluntly rounded.

The radula (fig. 3 *d*) has the formula

$$38 \,.\, 1 \,.\, 12 \,.\, 1 \,.\, 12 \,.\, 1 \,.\, 38$$

or

$$51 \,.\, 1 \,.\, 51.$$

Central and admedian as usual, the marginals unevenly bicuspid, the inner point much the longest, those on the extreme edge very minute.

Jaw (fig. 3 *c*) arched, narrow, with a slight central projection, differing much from that of *M. hardwickei*.

Macrochlamys angigyrata, G.-A., MS. (Plate CXXXI. fig. 11; Plate CXXXII. fig. 8, animal.)

*Locality.* Nemotha Hill (Trigonometrical Station), Cachar (*J. Wood-Mason*).

Shell depressedly conoid, narrowly perforate, thin, glassy, shining; sculpture very fine microscopic longitudinal striation, not seen on the apical whorls; colour pale straw or ochraceous, a

few with an umber tint; spire subconoid; suture impressed; whorls 6, closely or regularly wound; aperture semilunate, subvertical; peristome thin; columellar margin subvertical, slightly reflected next umbilicus.

Size: maj. diam. 11·75, min. 10·0; alt. axis 5·0 mm.

On Nemotha Mr. J. Wood-Mason collected a number of species of this genus, labelling them from $M^0$, $M^1$–$M^5$; it would appear thereby he had noticed differences in the animals, and in all probability notes were made of them; unfortunately neither these nor specimens preserved in spirit bearing similar labels have come to hand, they would have been most valuable.

No. 1752 B.M. Coll.

Three specimens in which the dried-up animal was noticed were put to soak; unfortunately, when examined, the soft parts had decayed, but out of two the jaw and radula were secured.

The formula of the radula is

$$48 . 2 . 12 . 1 . 12 . 2 . 48$$
$$62 . 1 . 62.$$

The jaw has a small median projection.

Only the jaw of No. 1758 was found.

The animal (Plate CXXXII. fig. 8) has a very long right shell-lobe, even in the contracted state of the one examined, so that it must be unusually long in life, there is also a narrow much shorter left shell-lobe. The mantle zone is margined with a well-marked black band, the rest of the wall of the branchial chamber is quite plain. The mucous gland at the extremity of the foot is covered by a large upright lobe, bending over in life; the visceral sac is mottled with white.

MACROCHLAMYS STRIATICOSTATA, n. sp., Nevill MS. (Plate CXXXII. fig. 5.)

*Locality.* Silchar, Cachar (*J. Wood-Mason*). Type, Indian Museum, Calcutta.

Shell globosely conoid, narrowly umbilicate; sculpture indistinct microscopic longitudinal striation, somewhat flat on the base which is polished, crossed by close irregular folds of growth, costulate in type; colour pale ochraceous and umber; spire conoid, high, sides slightly convex, apex rather pointed; suture rather shallow; whorls 6, very regularly increasing; aperture semilunate; peristome thin; columellar margin oblique, not thickened and scarcely reflected.

Size: maj. diam. 9·75, min. 9·0; alt. axis 5·9 mm.

There is only one example of this species, and I should hesitate to describe it were it not so very distinct from any I have seen from this part of India, and would be so easily recognizable when found again.

MACROCHLAMYS TERMINALIS, G.-A. (Plate CXXXI. fig. 8.)

*Locality.* Lhota Naga Hills (*Wm. Chennell*).

Shell flatly conoid, glassy surface, scarcely perforate; sculpture fine regular longitudinal striation; colour umber-brown; spire low, apex rounded; suture impressed; whorls 6, increasing very regularly to the aperture; aperture lunate, subvertical; peristome thin; columellar margin oblique, not thickened and very slightly reflected.

Size: maj. diam. 11·75, min. 11·5; alt. axis 5·0 mm.

There are some ten specimens from the above locality and four from the Diyung Valley, Singpho Hills, found by Mr. Ogle; these last are flatter. This species is remarkably like *M. terminus*, and when describing that species I gave the Diyung Valley and Lhota Naga Hills as two of its habitats. On finding that the sculpture was so different, I looked more closely at them, and found the coil of the whorls and the very close perforation clearly separated them. The two drawings of the shell seen from above, show the greater increase in the size of the last whorl in *M. terminus*.

MACROCHLAMYS ? DIKRANGENSIS, n. sp. (Plate CXXXI. fig. 5.)

*Locality.* Dikrang Valley, Dafla Hills (*Godwin-Austen*).

Shell imperforate, depressedly conoid, base flat; sculpture distinct irregular fine longitudinal striation, with regular transverse waves of growth which to the eye give a costulate appearance; colour pale ochraceous, pale olivaceous spots on the animal's body showing through the shell; spire flatly conoid, sides slightly convex; apex rounded; suture shallow; whorls $6\frac{1}{2}$, closely wound, regularly increasing, the last slightly descending; aperture oblique; peristome somewhat thickened, sinuate on the lower margin; columellar margin very oblique, rather thickened, not reflected.

Size: maj. diam. 13·6, min. 12·75; alt. axis 6·5 mm.

This is the species which Nevill in his Hand-list considered a variety of No. 137. *Nanina* (*Microcystis*) *petasus*, Bs. p. 35 ("? distinct species"), "2 Dikrang, type var." I had given these to the Indian Museum on my return from the Dafla Expedition, and Nevill returned one of them to me, this I have figured; the other should be in Calcutta. These came from the forest bordering the Dikrang River. I have specimens from Toruputu Peak, 5000 ft., of same size, rather smoother; from Tanir Peak, much smaller, only 9 mm. in major diameter (10 Tanir of Nevill's Hand-list, p. 35). It was found also on Shengorh Peak and at Borpani; it is a common shell in these hills.

The animal was not seen, and there is considerable doubt as to its being a *Macrochlamys*. When it is examined, it is not improbable a new genus will have to be made, which cannot be done on shell-character alone.

Macrochlamys ganjamensis, n. sp. (Plate CXXIII. figs. 4 & 5.)

*Locality.* Ganjam.

Shell globosely turbinate, perforation concealed, covered with a thick epidermis; sculpture, crossed transversely by fine irregular close raised striation, the striæ having the appearance of close-set dots; colour dull umber-brown, paler on underside and glassy; spire pyramidal, sides flat, in one specimen out of 17 the spire was depressedly pyramidal; suture well impressed; whorls 6, convex, gradually increasing, the last somewhat more rapidly, and tumid; aperture circular; peristome thin and marked by a dark edge of epidermis; columellar margin nearly vertical, weak, and very slightly reflected near the umbilicus.

| | Major diam. | Minor diam. | Alt. axis. |
|---|---|---|---|
| Size: ................ | 17·75 | 14·00 | 8·00 mm. |
| Largest specimen .... | 18·50 | 17·00 | 8·50 ,, |
| A depressed specimen.. | 18·00 | | 7·5 ,, |

This species was sent to me from the Calcutta Museum, labelled *M. subjecta*, Bs., but it is certainly not that species. The sculpture is very peculiar and new to me. It would be interesting to see the animal of this species.

Macrochlamys chaos, W. Blf. (Plate CXXVIII. fig. 2.)

*Macrochlamys chaos*, W. Blf., P. Z. S. 1904, ii. p. 444, pl. 25. fig. 8.

Faun. Brit. Ind., Moll. (1908), p. 116, described as follows:—

"Shell perforate, conoidly depressed (subglobose), thin, smooth, transversely striated, and with microscopic, very fine, close, flexuous, longitudinal (spiral) sculpture, vitreous, pale fulvous or whitish horny; spire low, apex acute, suture impressed; whorls $5\frac{1}{2}$, slightly convex, the last broader, rounded externally, convex beneath; aperture oblique, roundly lunate, the breadth exceeding the height; peristome very thin, in one plane, columellar margin curved, vertical above and briefly triangularly reflected.

"Major diam. 16, min. 14, height 8 mm. A small specimen measures 13 × 12 × 7.

"*Hab.* Pegu; Thayetmyo; Upper Burma, Tsingu near Ava. Type figured (*W. T. B.*).

"This species resembles *M. subjecta*, but is distinguished by being more lustrous and globose, and by its narrower last whorl and smaller mouth, as well as by its longitudinal striation, which is sometimes difficult of detection."

Macrochlamys superflua, W. Blf. (Plate CXXVIII. figs. 7, 7 *a*, 7 *b*.)

*Macrochlamys superflua*, W. Blf. P. Z. S. 1904, ii. p. 442, pl. 25. fig. 7.

Faun. Brit. Ind., Moll. p. 88.

Dr. Blanford's description:—

"Shell perforate, depressed, thin, polished, microscopically marked

with faint, subdistant, longitudinal (spiral), impressed lines above and often below, the spaces between the lines papillate, pale yellowish to brownish horny; spire low, suture well impressed; whorls 6, rather rapidly increasing, the last broader, rounded at the periphery and convex beneath; aperture slightly oblique, subovately lunate, broader than high; peristome thin, basal margin almost straight when viewed from below, columellar vertical above, then obliquely curved, rather broadly reflected at the perforation.

"Major diam. 20, min. $17\frac{1}{2}$, height 10 mm.

"*Hab.* Sikhim. Common in the Upper Teesta Valley about Singtam (4000′–5000′).

"This somewhat resembles *M. sequax*, but is distinguished by larger size and different sculpture. It is also very much like immature shells of *M. lubrica*, but may be known by the presence of longitudinal sculpture, more numerous whorls, colour, &c."

I give drawings of this species so that they may be compared with *M. sequax*, figured on Plate CVI. fig. 1.

Macrochlamys rakaensis, G.-A. (Plate CXXVIII. figs. 1, 1 *a*.)

*Macrochlamys rakaensis*, G.-A. Moll. Ind. ii. 1907, p. 164, pl. cx. figs. 2–2 *b*; W. Blf. & G.-A. Faun. Brit. Ind., Moll. (1908) p. 88.

*Locality.* Near Darjiling (*Colonel G. B. Mainwaring*).

Shell well perforated, depressedly conoid, slightly shiny, thin; sculpture well marked longitudinal striation, in places broken up into papillate dots, extending to the lower side; colour olivaceous umber-brown or ochraceous, on some a whitish narrow streak extends from umbilicus close to peristome; spire flatly conic, apex blunt, sides flat; suture impressed; whorls $5\frac{1}{2}$, regularly increasing to the fourth, the last more expanded; aperture roundly lunate, oblique; peristome thin; columellar margin subvertical, very slightly reflected above.

Size: maj. diam. 12·4, min. 11·3; alt. axis 5·5 mm.

Eight adult and seven very young specimens were sent me by Mr. G. Nevill many years ago, from what part of the Darjiling hills was not stated. Colonel Mainwaring had native collectors out, and perhaps took no special care to record the exact habitat.

The sculpture of this species is sufficient to distinguish it from shells of very similar form. The original description and figure were made from an immature shell.

Macrochlamys stephus, Bs. (Plate CXXVIII. figs. 6, 6 *a*.)

Bs. (*Helix*) A. M. N. H. (3) vii. 1861, p. 84; Pfr. (*Helix*) Mon. Hel. v. p. 105; ? H. & T. (*Helix*) C. I. 1876, pl. 62. figs. 4, 5, 6; Nevill (*Nanina* (*Macrochlamys*)), Hand-l. i. 1878, p. 23; G.-A. A. M. N. H. (6) ii. 1888, p. 56; id. P. Z. S. 1895, pp. 441, 446; id. Moll. Ind. ii. p. 50.

Faun. Brit. Ind., Moll. p. 127:—

"Shell narrowly perforate, depressed, smooth, with faint microscopic traces of minute, close, spiral (longitudinal) striation, polished, pale yellowish or greyish brown; spire very depressedly conoidal, suture faintly impressed; whorls 6–7, slightly convex above, increasing slowly and regularly, the last rounded outside, obtusely subangulate above the periphery in immature shells, convex beneath; aperture slightly oblique, lunate; peristome thin, upper margin straight, basal slightly arcuate, columellar oblique, expanded throughout the greater part of its length, more broadly above.

"Major diam. $12\frac{1}{2}$, min. 11, height nearly 6 mm. A rather smaller specimen with 6 whorls measures $11\frac{1}{2} \times 10\frac{1}{2} \times 5$ mm.

"*Hab.* Mount Harriet, Port Blair, South Andaman Island.

"Benson's type measured only 10 mm. in major diameter.

"The figures in the 'Conchologia Indica' are not good, and perhaps represent a different shell. *M. stephus* may be recognized by its closely-wound whorls, low spire, and want of distinct sculpture under the microscope.

"Animal throughout yellow, except the tentacles, which are black, sole of foot also yellow (*Nevill*).

"[In a specimen recently examined, sent home by Mr. G. Rogers from South Andaman Island, a minute left shell-lobe is present, contracted and hooked in the spirit-specimen. Preserved in this way and brittle, it would very readily be broken off. The penis has a small coiled cæcum; the jaw a small central projection. In the radula the laterals are slightly curved aculeate teeth, and the formula is

$$\frac{30 . 1 . 10 . 1 . 10 . 1 . 30}{41 . 1 . 41}$$

in all respects similar to that of *M. exul.*]"

Macrochlamys kumahensis, Theob. & Stol. (Plate CXXVIII. fig. 8; from specimen in Dr. W. T. Blanford's collection.)

*Nanina ramriensis*, Blf., Nevill, Hand-l. i. p. 24 (no description).
*Macrochlamys kumahensis*, Theob. & Stol. J. A. S. B. 1872, 2, p. 334, pl. 11. figs. 9, 10; Pfr. (*Helix*) Mon. Hel. vii. 1876, p. 531; Nevill (*Nanina*), Hand-l. i. 1878, p. 25.

Faun. Brit. Ind., Moll. p. 117:—

"Shell openly perforate, depressed (almost subglobose), thin, smooth, polished, with close, minute, longitudinal (concentric) striation, only visible under a microscope, above and below, yellowish to brownish tawny; spire low, suture rather well impressed; whorls $4\frac{1}{2}$, convex, subangulate outside the suture; the last considerably broader, well rounded at the periphery and rather tumid below; aperture oblique, roundly lunate, almost circular; peristome thin, straight, columellar margin much curved, becoming vertical above, and rather broadly triangularly expanded.

"Major diam. $9\frac{1}{2}$, min. $8\frac{1}{2}$, height $5\frac{1}{2}$ mm.

"The form named *ramriensis* (but never described) is slightly larger, measuring 10½ mm. in diameter, and has a rather larger mouth, but, as suggested by Nevill, is not distinguishable."

*Localities.* Kumah Hill near Sandoevay, Arakan (*Theobald*); Ramri Island, Arakan Coast (*W. T. B.*). Shell figured.

A well-marked species, somewhat resembling *M. subjecta* in shape.

I have not seen the type shell of *M. kumahensis*, it is in the Indian Museum, Calcutta, but there is a single specimen in the Natural History Museum from the typical locality, which came out of Mr. Theobald's collection; it agrees well with the specimens from Ramri Island.

The shells included by Nevill from the Dafla Hills, Assam, and Bhamo, are different species; they have been sent home and have been identified by me.

MACROCHLAMYS KUMAHENSIS, Theob. & Stol. (labelled *ramriensis*, Blanford MS.). (Plate CXXIII. fig. 8; from Indian Museum, Calcutta—very globose variety.)

From "Ramri, coll. W. T. Blanford, Esq."

Nevill, Hand-l. i. 1878, p. 24, sine descr.

Shell perforate, globosely conoid, solid; sculpture, shell drawn, bleached; 2nd specimen not fully grown, covered with an epidermis showing no sculpture; 3rd specimen, young, fresh, shows a *rather coarse longitudinal striation*; spire low, rounded on the apex; suture shallow; whorls 5, increasing regularly; aperture semi-oval, oblique; peristome slightly thickened; columellar margin oblique, short, reflected near the umbilicus.

Size: maj. diam. 11·75, min. 10·5; alt. axis 5·5 mm.

Three specimens M. 3682, No. 44, Hand-list, p. 24, were received from the Indian Museum, Calcutta, and were compared and found similar to shells labelled *ramriensis* in Mr. W. T. Blanford's collection.

MACROCHLAMYS SILVATICA, n. sp. (Plate CXXIII. fig. 7.) Type in B.M. Coll.

*Locality.* Tanir Ridge, Dafla Hills (*Godwin-Austen*).

Shell globosely conoid, perforation nearly concealed, shiny surface, somewhat solid; sculpture, the first whorls are nearly smooth, but on the last coarse parallel longitudinal striation is present; colour olivaceous, apical whorls in one specimen ochraceous, with a narrow band behind the peristome of same colour; spire moderately high, subpyramidal, sides flat, apex blunt; suture impressed; whorls 6, evenly wound, well rounded on the periphery; aperture semilunate, subvertical; peristome thin; columellar margin oblique, not thickened, and very slightly reflected high up.

Size: maj. diam. 17·0, min. 15·0; alt. axis 8·5 mm.

Largest specimen: maj. diam. 17·75, min. 16·0, alt. axis 8·8 mm.; in Calcutta Museum.

This species is recorded in my Field-book as No. 1074 *a*, and was handed to Geoffrey Nevill with a number of other species from the Dafla Hills to be worked out. The four specimens have lately come back through the kindness of Mr. N. Annandale, the present Superintendent of the Calcutta Museum.

The animal was described as follows:—"Entirely dark slate-colour. Length 1·3 inch; body long and thin."

"Shell: major diam. 0·7 inch."

In one specimen was a dried-up animal, which was put to soak, and after 10 days the mucous gland at end of foot was plainly seen.

There is a very remarkable resemblance between this species and *Staffordia toruputuensis* and *S. staffordi* in coloration and general form. Placed side by side the differences are clearly seen, and the presence of a mucous gland, which the genus *Staffordia* does not possess, establishes the species. Compare fig. 7 with figs. 2, 3, and 4, Plate CXIII.

MACROCHLAMYS? HYALINOIDEA, n. sp. (Plate CXXVIII. fig. 11.)

*Locality.* Tundiani, nr. Abbotabad, Punjab, 8500 ft. (*Theobald*).

Shell globosely discoid, perforate; sculpture, very indistinct longitudinal striation, nearly smooth; colour pale ochraceous, white around the umbilicus; spire low, apex and sides rounded; suture shallow; whorls 5, increasing regularly; aperture rather narrowly lunate; peristome thickened, with a minute blunt process on the outer upper margin, just within the edge of the peristome; columellar margin very oblique and straight, not reflected, thickened.

Size: maj. diam. 7·4, min. 7·0; alt. axis 3·0 mm.

I place this provisionally in *Macrochlamys*, as there is no other genus to receive it; points of shell character denote separation, but until the animal is seen and examined nothing more can be done.

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## Genus AUSTENIA.

(*Continued from* Vol. II. p. 174.)

At the top of this page, I said as to *Euaustenia*, Cockerell, type *scutella* ("Notes on Slugs," Ann. & Mag. Nat. Hist. ser. 6, vol. vii. January 1891), that until *Austenia* (?) *monticola* and other West Himalayan species had been examined, we could not be certain what species should be included in it.

I have lately (July 1907) received two collections preserved in spirit from Mr. N. Annandale, of the Indian Museum, Calcutta, from Naini Tal and Simla, which contain specimens of several species I have long wanted to see, among them two of this genus,

*Austenia.* I have also another species from Chamba, which I consider to be *scutella.*

On page 214, Vol. I., I described and figured, with considerable doubt, a species from Uri, in the valley of the Jhelum, Kashmir Territory, under the title *cassida.* Theobald, who sent it to me, in one letter refers to it as that supposed *cassida* after seeing the Simla specimens.

I now feel satisfied that this Kashmir shell belongs to quite a different group, of which *Macrochlamys flemingi* may be taken as the type *. It comes nearest to *Parvatella austeniana* and was found in company with *P. altivaga*; both of which I notice have similar fine longitudinal striation.

The species in spirit sent me by Mr. Annandale clear up all doubt as to the generic position of *cassida.* There are some eight specimens, pale grey or flesh-colour, and recall at once Hutton's excellent description of the animal of *cassida* in the J. A. S. Bengal, which I gave in full on p. 215, Vol. I. The shells of these Simla specimens are flat on the apex, and agree with the description of *monticola*, Pfr., and here the confusion between *monticola* and *cassida* is apparent; the type-shell Pfeiffer described as *monticola* really came from Simla, and not Mussoorie; what Hutton and Benson knew as *monticola* came from the last-named place.

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EUAUSTENIÆ—as a section of *Austenia*—was indicated by Cockerell, "Notes on Slugs," A. M. N. H. (6) vii. p. 98, 1891 (description limited), "with an amatorial organ," type *scutella*: Nautilus, xii. 1898, p. 10. No doubt based on description and drawings, *vide* Moll. Ind. vol. i. 1888, p. 232, pl. lii. figs. 1–1 *e*, animal figs. 1–1 *a*; from Murree in the Punjab, Outer Himalaya.

Genus EUAUSTENIA, Godwin-Austen, Faun. Brit. Ind., Moll. (1908), p. 148.

*Original description*:—"Shell differs from that of *Austenia gigas* in being more heliciform, shelly and thin. The animal has large leaf-like right and left shell-lobes, which in life nearly cover the whole of the shell. In the genitalia the penis has a coiled cæcum near the retractor muscle, and is thus similar to *Macrochlamys*."

I have now dissected the animals of *Euaustenia* from four widely separated localities—Naini Tal (Plate CXXIV. fig. 2), Simla (Plate CXXIV. fig. 1), Chamba, and Murree, some 480 miles from east to west: they prove to be closely allied. The Simla species was the first to be described by Captain Hutton in 1838 as *Vitrina cassida*, long before *Vitrina monticola*, 1848, Pfr. *monticola*, Bs. MS., is the Mussoorie and Landour shell, which is never so flat on the apex as *cassida* of Simla; Pfeiffer described it, adopting the same name, in the P. Z. S. 1848. *scutella*, Bs., is another form, the shell being still flatter above and still more depressed; *stoliczkana*, Nevill (Plate CXXXI. figs. 1, 1 *a*), is the

* This shell has been made the type of a new genus, *Parvatella*, by W. T. Blanford, Faun. Brit. Ind., Moll. (1908), p. 145.

form from Almorah; *theobaldi*, G.-A., another far more globose shell, from the Chenab Valley, Kashmir. They would, no doubt, if we could obtain shells from intermediate localities, be found to gradually merge the one into the other; probably also in the markings and colour of the animals more variation would be found than in the shape of the shell.

### Genus Euaustenia, Cockerell.

Faun. Brit. Ind., Moll. (1908), p. 148.

A more detailed description of the genus is as follows :—

Animal with large shell-lobes which in life spread out, covering and concealing the shell, they narrow posteriorly, are continuous, and unite below the shell on the dorsal side of the foot. The right shell-lobe is ovate, the left triangular, in some species smooth, in others more or less papillate. In forms from Simla and Naini Tal, both lobes are adorned with one or more branching vein-like markings, giving the lobes a leaf-like appearance. The foot is divided, the mucous pore has a lobe above it. The genitalia are similar to those of *Macrochlamys*, the penis with a distinct coiled cæcum and a large amatorial organ; a moderately long kalc-sac. The jaw has a central projection, and the radula is as in *Macrochlamys*.

The shell is helicoid with about four whorls, thin, more or less depressedly globose.

Young shells are more polished than those fully grown.

I adopt Mr. Cockerell's suggested section because these N.W. Himalayan forms are, in spite of shell differences, so close to *Macrochlamys*; further, the internal organs occupy as in that genus the anterior part of the body, below the neck, whereas in *Austenia* type (*gigas* for instance) they occupy a cavity of the foot as far back as the posterior side of the shell, resting on the sole of the foot. The generative organs also differ, and so does the shell.

Euaustenia cassida, Hutton. (Plate CXXIV. fig. 1.)
J. A. S. B. vii. (1838) p. 214.

*Locality.* Martiani, Simla Hills, 8000 ft. (*N. Annandale*).

Seven specimens in different stages of growth show in an interesting way the proportion the size of the shell bears to that of the animal. In colour these spirit-specimens are a pale grey; one is much paler than the other. There are no markings of any kind; in one only 10 mm. in length the eye-tentacles are dark coloured, the rest of the body being very transparent. The largest measured about 33 mm. in length. All have a midrib on the ample right shell-lobe giving off branches; the left shell-lobe is large, triangular, and pointed behind. The visceral sac seen through the transparent shell has some mottling on it.

The animal of *E. cassida* (var. *stoliczkanus*) of Nevill, from Naini Tal, is shown on Plate CXXIV. fig. 2. It is in every respect similar to the Simla mollusc.

Euaustenia scutella, Benson. (Plate CXXIV. figs. 3, 3 *a*, 3 *b*, 3 *c*.)

*Locality*. Chamba.

*Genitalia*. To the penis (fig. 3 *a*, 3 *b*) there is a short kale-sac where the vas deferens joins, the epiphallus is long, a cæcum is given off from the head of the penis-sheath and is closely coiled, to this the retractor muscle is attached—in every respect it is like the male organ of *Macrochlamys*. The amatorial organ (fig. 3) is stout, sausage-shaped, at the distal end tapering rapidly to the retractor muscle. The spermatheca is rather long and pear-shaped.

Jaw (fig. 3 *c*) well arched, with a strong central projection. Radula formula:

25 . 1 . 17 . 1 . 17 . 1 . 25

or 43 . 1 . 43.

Centre tooth bicuspid, admedians with one large cusp on the outer side, and a small cusp on upper inner side below point, marginals unevenly bicuspid.

Euaustenia scutella, Benson, var. (Plate CXXIV. figs. 4–4 *d*.) (Plate LII. Vol. I., figs. 1, 1 *a*, 1 *b*, animal.)

*Locality*. Murree, Punjab Himalaya.

The form from this locality, far to the north-westward, departs slightly from that of Chamba.

The genitalia (fig. 4) are on the same plan, with this variation—the amatorial organ is very globose and club-like, attenuate near the generative aperture; in the penis the kale-sac is shorter.

The radula has a greater number of admedian teeth, viz.:—

+ 1 . 20 . 1 . 20 . 1 +

or 41 to 35 central and admedian.

In the Chamba form the marginals were not perfect, only a slight indication of an upper inner cusp to the admedian teeth. The jaws (fig. 4 *d*) differ very much in their form, that of the Murree species being less solid and differently arched.

The spermatophore (fig. 4 *a*) is a beautiful elongate delicate object, the capsule alone being nearly 8 mm. in length, it is longer than any I have as yet come across. The spines on the flume next the capsule (fig. 4 *b*) are bicuspid, on one side only they do not extend far, and are soon succeeded by minute straight spines on both sides of the flume, larger near the end (fig. 4 *c*).

Mr. Benson described *E. scutella* from a specimen sent to him by Mr. W. Theobald from Nasmana on the Chinab River (Plate LII. Vol. I., figs. 1 *c*, 1 *d*, 1 *e*), some 50 miles up the valley from its debouchement into the plains. Chamba is not far off on the south-east, practically in a similar country and similar climate, and what might be called the same drainage area. I therefore am led to consider the Chamba specimen described as closest to the type, whereas Murree is more remote to the north-west, and in quite a distinct drainage area of the Indus; the small differences between the two constitute the Murree form as a variety.

Euaustenia lumsdeni, n. sp. (Plate CXXIII. figs. 1, 1 *a*.)

*Locality.* Kuram Valley, N.W. Frontier, Punjab (*M. J. Ogle*).

Shell ovoid, depressed, scarcely perforate, hidden by callus, solid; sculpture, perfectly smooth and shining surface; colour of fresh shells unknown, all the specimens are milky white and bleached, most of them filled and covered with fine mud such as that of irrigated fields; spire low, very flatly conoid, apex very slightly raised above the last whorl; suture impressed; whorls 4, increasing rather rapidly, the last large and ample; aperture very broadly flatly lunate, very oblique; peristome thin, sinuate near the inner upper angle; columellar margin not thickened, rounded, reflected into a callus, covering the perforation.

The animal is unknown; the shell-character is that of the genus *Euaustenia*, and if on dissection it proves to belong to it, the Kuram Valley will be its most westerly extension.

| | | mm. | | mm. | | mm. |
|---|---|---|---|---|---|---|
| Size, of spec. figured: | maj. diam. | 19·0, | min. | 16·0, | alt. axis | 6·75 |
| ,, of largest: | ,, | 20·25, | ,, | 17·0, | ,, | 8·6 |

I have pleasure in naming this species after General Sir Peter Lumsden, G.C.B., C.S.I., who, when in the Quartermaster-General's Department at Peshawar, was the first officer to make a Plane Table Survey of the Kuram Valley, the fair map of which he gave me to draw and compile prior to its publication in the Surveyor-General's office, Calcutta, in 1856, and which led to my own appointment to the Kashmir Survey Party in 1857.

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## Subfamily Helicarioninæ.

Moll. Ind., Vol. I. p. 146, Plate XLI.

In this work as far as Part X. 1907, the genus *Austenia* of Geoffroy Nevill has had included in it a large number of species, many of which differ very much in form of the shell from the type of the genus, viz. *A. gigas*, Bs., while considerable similarity occurs in the internal anatomy.

The anatomy of those that had been examined was not at all like that of Australian species constituting true *Helicarion*. With the preparation of the volume on Mollusca of the 'Fauna of British India,' published in June 1908, the time had arrived to make an attempt to improve classification based on the anatomical investigations of previous years, and it became necessary to restrict *Austenia* to forms like the type shell, while for the shells hitherto included in it, differing in various degrees in their shell characters and internal detail, the following generic divisions were adopted:—

I. *Cryptaustenia*, with 10 species.
*C. succinea* type, *ovata*, *heteroconcha*, *verrucosa*, *durrangensis*, *zemoensis*, *silcharensis*, *globosa*, *bensoni*, *panchetensis*.

2. *Eurychlamys*, with 2 species, 3 with *todarum* since added.
   *E. platychlamys* type, *regulata.*
3. *Austenia*, with 11 species.
   *A. gigas* type, *butleri, resplendens, venusta, magnifica, nagaensis, cacharica, solida, peguensis, shanensis, sikkimensis.*
4. *Girasia*, with 9 species.
   *G. hookeri* type, *radha, crocea, pankabariensis, dalhousiæ, burtii, ? cinerea, affinis, ? dikrangensis.*
5. *Cryptogirasia*, a single species.
   *C. rubra* type.*
6. *Mariœlla*, 2 species.
   *M. dussumieri* type, and *beddomei.*
7. *Pseudaustenia*, 2 species.
   *P. atra* type, and *auriformis.*
8. *Cryptosoma*, 3 species.
   *C. præstans* type, *inusitatum, birmanicum* [*? austeni*].

## Genus CRYPTAUSTENIA.

*Cryptaustenia*, Cockerell, section of *Austenia*, "Notes on Slugs," A. M. N. H. (6) vii. 1891, p. 99 (no description, type *A. planospira*, Bs.: as a section of *Helicarion*); id. Nautilus, xii. 1898, p. 10.

Faun. Brit. Ind., Moll. (1908), p. 180.

Type, *succinea*, Reeve=*planospira*, Bs.

"Shell imperforate, thin, diaphanous, smooth, depressed; whorls 3–4½, rapidly increasing, the last large and rounded; aperture large, oblique; peristome simple, more or less membranaceous.

"The animal has the shell-lobes of the mantle broad but divided from each other and almost or quite concealing the shell when fully expanded. Peripodial groove and mucous pore strongly developed, a projecting lobe above the latter. *Genitalia chiefly distinguished from* Macrochlamys *by the absence of a coil for* (more correctly *near*) *the attachment of the retractor muscle of the penis.* Radula with a tricuspid rhachidian tooth and rather numerous broad inner laterals bi- or tricuspid, together with a much smaller number of outer pointed bicuspid laterals than in typical *Girasia*, and the outer cusp of these is outside remote from the end.

"This group is at once distinguished by its shell from *Girasia* and *Austenia*. It chiefly differs from *Vitrina* by having a mucous pore, and the genitalia are quite different."

CRYPTAUSTENIA BENSONI, Pfr., *vide* AUSTENIA BENSONI, Pfr.

*Continued from* Vol. I. p. 150: Plate XXXVI. fig. 6, animal, figs. 7, 7 *a*, 7 *b*, shell; Plate XXXVIII. fig. 2, radula. Calcutta specimen.

* The generic relations of the animal are doubtful, it has a rudimentary small oval shell, but the internal anatomy has yet to be investigated. I found it close under the village of Kohima in the Naga Hills, under stones and decaying logs on the north side of the hill. Anyone finding and preserving this animal will be doing a great service to Indian Malacology.

Cryptaustenia bensoni, Pfr., var. (Plate CXXIII. figs. 10, 10 *a*; Plate CXXIV. figs. 5, 5 *a*, 5 *b*.)

*Locality.* Rajmahal (Indian Museum collector, *N. Annandale*, 31.vii.1907).

Shell is much more globose and not so flat on the spire as in *C. silcharensis*, G.-A., Vol. II. 1907, p. 170, Pl. CVII. figs. 1–3 *c* (shell, animal, & anatomy).

The type shell described by Pfeiffer was from the Botanical Gardens, Calcutta; the shell referred to by me in Vol. I. p. 150, I obtained in Jessore a few miles east of Calcutta, it is figured on Plate XXXVI. figs. 7, 7 *a*. I have now been able to obtain, through the kindness of Dr. N. Annandale, specimens from Rajmahal, some 180 miles up the Ganges delta from Calcutta. The animal from this locality is very much mottled with black particularly on the extremity of the foot and the left shell-lobe, much more so than in the Calcutta specimens I have seen. The form of the shell varies also, *vide* Plate CXXIII. figs. 10, 10 *a*; this may be noticed in the apex, in the coil of the whorls, and in its more globose shape. It is not at all like *C. panchetensis*, G.-A., from Ranigunj, which may be considered a variety of *bensoni*. The genitalia of *C. bensoni* were not described in Vol. I., this I am now able to supply. They are similar to those of *Cryptaustenia succinea*, the type of the genus.

The animal (Pl. CXXIV. fig. 5), compared with *C. silcharensis*, has the extremity of the foot more pointed and overhanging; it is much more speckled as well as the shell-lobes, these are not so coarsely papillate, the right shell-lobe is finely papillate; individuals differ in the extent of the speckling. *There are three peripodial grooves.* The branchial sac is mottled and spotted. The right dorsal lobe small, finely papillate; the left narrow, not divided. The left shell-lobe (fig. 5 *a*) narrow on the front side, rapidly widening on the left side, it is streaked and spotted black on a white ground.

*Genitalia* (fig. 5 *b*): The male organ has a short thickened epiphallus, no kalc-sac; the retractor muscle, given off at the bend or head of the organ, is very long; the spermatheca is short and globose; the amatorial organ remarkably long and large for the size of the animal, and its shape differs much from that of *C. silcharensis*.

Cryptaustenia salius, Bs.

Moll. Ind., Vol. I. 1883, p. 152, Plate XXXVII. fig. 1; id. Vol. II. 1898, p. 65.

Faun. Brit. Ind., Moll. p. 217.

Although Dr. W. T. Blanford included this species in the genus *Durgella* in the last quoted work, on opinions I expressed, I think

it better, until the question is cleared up by the anatomy of the animal, to include it in *Cryptaustenia.*

*Austenia salius*, Bs., var. *ovata*, G.-A., from Punkabari, Darjiling, coll. W. T. B., figured on Plate XXXVII. figs. 2, 2 *a*, is, I consider, very likely to be *Helicarion ovatum* of Henry F. Blanford.

*Macrochlamys ovata*, H. Blf., recorded by me in a "List of the Dafla Hill Shells," J. A. S. B. 1876, p. 312, was a wrong determination; it is quite distinct, and now stands as *M. beata*, G.-A. Moll. Ind. ii. 1899, p. 156, Pl. CVIII. figs. 1, 1 *a*, 1 *b*.

Cryptaustenia ovata, H. Blf. (Plate CXXIII. figs. 11, 11 *a*.)

H. Blf. (*Helicarion*) J. A. S. B. vol. xl. pt. 2 (1871) p. 44, pl. ii. fig. 9; Faun. Brit. Ind., Moll. no. 278, p. 182 (1908).
Nevill, Hand-l. i. 1871, no. 16. 10 Darjiling (H. F. Blanford and Col. G. Mainwaring).

Original description:—"*Testa depressa, peripluriâ ovatâ, solidiuscula, diaphana, fuscescente cornea, polita, obsolete arcuatim striata. Spira parum convexa; apice vix exserto. Anfractus* $3\frac{1}{2}$, *rapide accrescentes; ultimus descendens. Sutura impressa, marginata. Apertura obliqua, depresse lunata. Peristomatis margo columellaris subverticalis; basalis leviter arcuatus.*

"Diam. major 11·5 mm., minor 9 mm., axis 5 mm.

"Aperturæ alt. 5, lat. 7 mm.

"Cepit Dr. F. Stoliczka apud Darjeeling.

"Distinguished from *H. salius*, Bens. sp. (with which it is associated) by its larger size, more depressed form and simple peristome, not recurved at the columella. On the other hand, it is smaller, more solid, and more globular than *H. planospira*, Bens. sp. From *H. scutella*, Bens. sp., and *H. bensoni*, Pfr. sp., it differs by its greater solidity, its highly polished surface, and the less rapid increase of the last whorl. It is also smaller than the former of these species."

I have not been able to find the type shell in Mr. H. F. Blanford's collection, which passed to his brother and then to the Natural History Collection.

Cryptaustenia heteroconcha, H. Blf. (Plate CXXVIII. fig. 14, shell; Plate CXXX. figs. 3, 3 *a*.)

H. Blf. (*Helicarion*) J. A. S. B. vol. xl. pt. 2 (1871) p. 45, pl. ii. figs. 8–8 *b*; Pfr. (*Vitrina*) Mon. Hel. vii. p. 10; H. & T. (*Vitrina*) C. I. pl. 152. figs. 8, 9; Faun. Brit. Ind., Moll. (1908), p. 183.

*Locality.* Siliguri, North Bengal (*Dr. Annandale*, Indian Museum collector).

Shell subovately depressed, thin, membranaceous; sculpture none, transversely crossed by strong striation of growth; colour pale ochraceous, internally milky white; spire low, apex flatly

rounded, scarcely rising above last whorl; suture very shallow; whorls 3, rapidly increasing, the last ample; aperture broadly lunate; peristome thin.

Size: maj. diam. 20·0, min. 15·5; alt. axis 6·0 mm.

This shell, the largest I have seen of the genus, from its great size compared with other species included in it, and from the description, can be no other than the above described by Henry Blanford in 1871, and figured on plate ii.; the shells on this plate were drawn by me in 1869 when staying with him at Calcutta. I have never seen this shell *heteroconcha* since, for it is not in his collection of shells at the Natural History Museum: its rediscovery at Siliguri is therefore important. It was originally found by Mr. W. S. Atkinson, of the Educational Department, who was a great collector of Lepidoptera, and Siliguri was no doubt often visited by him.

The animal (fig. 3) is white throughout, no markings; this whiteness may, I think, be attributable to the alcohol, for all the other specimens with it are in the same colourless state. The foot is truncate behind, slightly produced, and overhanging the linear mucous pore above; peripodial margin wide, and a well defined central area on the sole; right shell-lobe is elongate, rounded, papillated, some papilli being very large and conspicuous; left shell-lobe on wide base extending from near the respiratory orifice to hinder part of the visceral mass, triangular in shape, with a similar papillate surface; visceral sac grey.

The genitalia (fig. 3 *a*) are on the same plan as *C. succinea* = *planospira*, Bs., *vide* Vol. I. p. 149, Plate XXXVI. The amatorial organ is large and cylindrical, with a large, long and strong retractor muscle. The penis is a short stout tube, with a thick, very short retractor muscle attached to the wall of the branchial cavity, the vas deferens joins it at the apex and is short in length; the spermatheca is short and bulbous. The rest of the generative system does not call for any notice.

The radula was extracted quite perfect. The central tooth is tricuspid, the admedians have a small inner cusp just below the point and one basal outside; the first 15 marginals are bicuspid with the inner much the longest, this gradually rises higher, and the outermost are evenly bicuspid. The teeth are arranged:

$$72 . 2 . 17 . 1 . 17 . 2 . 72 = 91 . 1 . 91.$$

The teeth are similar in shape to those of *Girasia magnifica*, vide Plate LXII. fig. 2.

The jaw was not well preserved. It was concave on the cutting-edge, and there was no indication of a central projection.

Original description:—“ *Testa valde depressa, peripluriâ ovali, tenuis, diaphana, subtus membranacea, luteo-cornea, versus aperturam viridicans, polita, arcuatim obsolete striata, versus aperturam irregulariter subcostulata. Spira planata, apice vix exserto. Anfractus* 3, *rapide accrescentes; ultimus dilatatus vix descendens. Sutura*

*subimpressa, albido marginata. Apertura perobliqua, oblongo-ovata. Peristomatis margo anterior antice valde arcuatus; margo dexter subundulatus; margo basalis membranaceus.*

"Diam. maj. 17, minor 11 mm.; axis 5 mm.

"Aperturæ alt. 8, lat. 11 mm.

"Habitat apud Darjeeling.

"This very pretty shell is very distinct from any species hitherto described from Northern India. It is probably allied to some of the Ceylon species, which like it have a membranaceous base. I have had the specimens for some years in my collection. They were, I believe, obtained by Mr. W. S. Atkinson."

Cryptaustenia moyongensis, n. sp. (Plate CXIX. figs. 2–2 *c*; Plate CXXII. figs. 6, 6 *a*, 6 *b*.)

*Locality.* Moyong, N.W. Khasi (*G.-A.*).

Shell depressedly conoid, finely perforate; sculpture none, the epidermis with a surface like fine paper, distant shallow transverse lines of growth; colour ochraceous; spire low, blunt on apex; suture moderately impressed; whorls 4, rather rapidly increasing, the last tumid and rounded; aperture oblique, widely lunate; columellar margin not thickened and just reflected near the umbilicus.

Size: maj. diam. 13·5, min. 11·75; alt. axis 5·75 mm.

In a specimen received from Mr. Gude, the dried up animal was soaked out, showing it to be pale-coloured, streaked and mottled sparingly with black. The left shell-lobe (Plate CXXII. fig. 6) had a central pale line, with branches similar to what is seen in *Euaustenia cassida*, it is triangular in shape on a broad base, narrowing on the right and left, the right shell-lobe is broad; both expanding over the shell would cover the greater part of it in life.

The genitalia (fig. 6 *a*) were seen: the male organ is quite a simple sheath joined at the retractor muscle by the vas deferens; the spermatheca short; the amatorial organ very elongate, with a long well-defined point (fig. 6 *b*).

The radula has the formula:

80 . 2 . 12 . 1 . 12 . 2 . 80

or 94 . 1 . 94.

Cryptaustenia silcharensis, G.-A. (Plate CXXV. figs. 1, 1 *a*.)

Moll. Ind. ii. p. 170; Faun. Brit. Ind., Moll. p. 186.

*Locality.* Silcuri, Cachar (*J. Wood-Mason*). Coll. Indian Museum, Calcutta.

Shell not perforate, very tumidly globose, thin; sculpture none; colour pale ochraceous, with a greenish tint; spire very flat with rounded apex; suture impressed; whorls 4, rapidly increasing,

tumid, very round on periphery; aperture broadly lunate, very oblique: peristome thin; columellar margin slightly reflected, not thickened.

Size: maj. diam. 14·0, min. 12·0; alt. axis 6·0 mm.

Looked at from above the whorls are wound like those of *C. durrangensis*, G.-A. (Plate CVIII. fig. 5 *b*), but it is much more globose than that species.

A specimen in spirit received from Mr. F. Ede from Silchar, has a shell 14 mm. in major diameter and 5·5 height of axis. This is the largest I have seen.

In another specimen, shell 10 mm. major diameter, the formula of radula was 63 . 2 . 11 . 1 . 11 . 2 . 63 or 76 . 1 . 76; the excess being in the marginal teeth.

CRYPTAUSTENIA NONGSINGRIENSIS, n. sp. (Plate CXXV. figs. 5, 5*a*.)

*Locality.* Nongsingriang Wood, N.W. Khasi Hills (*G.-A.*).

Shell very globosely conoid, imperforate, covered with an epidermis; sculpture none, surface smooth; colour bright ochraceous; spire moderately high, depressedly conoid; suture shallow; whorls 4, tumid, rapidly increasing, the last very rounded on the periphery; aperture widely lunate, oblique; peristome thin; columellar margin vertical, not thickened, no reflection.

Size: maj. diam. 10·0, min. 9·0; alt. axis 5·25 mm.

CRYPTAUSTENIA OVUM, n. sp. (Plate CXXV. figs. 3, 3 *a*.)

*Locality.* Silcuri, Cachar (*J. Wood-Mason*).

Shell scarcely perforate, flatly tumidly globose, very thin, membranaceous; sculpture none, somewhat glassy; colour pale ochraceous or straw-colour; spire nearly flat; suture very shallow; whorls 3, very rapidly increasing, very rounded on the periphery; aperture very broadly lunate; peristome very thin, viewed from above very curved forward; columellar margin feeble, very slight, thickening near umbilical region.

Size: maj. diam. 13·5, min. 11·25; alt. axis 4·0 mm.

There are six specimens, the largest has been figured, the others are younger shells averaging 10·0 mm. in major diam.

This was labelled in pencil by G. Nevill *M. applanata membranacea*.

CRYPTAUSTENIA RARHIENSIS, n. sp. (Plate CXXV. figs. 2, 2 *a*.)

*Locality.* Rarhi Chu Valley, Sikhim.

Shell globose, very thin; sculpture none; colour pale umber; spire flattened and rounded; suture impressed; whorls 3, first two very small, body-whorl very ample; aperture very broadly lunate; columellar margin not seen.

Size: maj. diam. 14·0, min. 11·0 mm.

This species is so distinct from any of this genus hitherto

obtained in Sikhim, that although imperfect on the columellar margin, I describe it, as it cannot fail to be found again; its large body-whorl and sharply coiled apex distinguish it.

Cryptaustenia? helva, n. sp. (Plate CXXV. figs. 4, 4 *a*.)

*Locality.* South Sylhet Hills (*W. Chennell*).

Shell depressedly globose, not perforate, very thin, transparent, membranaceous; sculpture none, distant wavy lines of growth; colour bright golden ochre; spire but sparsely raised above last whorl; suture shallow; whorls 3, rapidly increasing, the last ample; aperture rotundately quadrate, broader than high, subvertical; peristome very thin; columellar margin nearly vertical.

Size: maj. diam. 12·0, min. 9·5; alt. axis 4·5 mm.

Sixteen specimens were collected, large and small, of this very pretty and distinct species of which the animal is not known. It in all probability belongs to the genus *Cryptaustenia*. Its nearest ally is *Cryptaustenia durrangensis* from Assam (*vide* Plate CVIII. figs. 5, 5 *b*).

## Genus Eurychlamys.

(*Continued from* Vol. I. p. 93.)

When looking over the fine collection of Indian land shells collected by William Blanford, and sorting out the valuable type shells which it contains, I have found four pill-boxes labelled *platychlamys*.

1. From the typical locality Bombay, some 14 specimens in all stages of growth. 2. From Champanir, near Broach, 19 specimens. 3. From the Wynaad, marked from Beddome, one fine specimen slightly broken, and a young shell. 4. One specimen of true *platychlamys*, no locality on box, with another species *tenuicula*, H. Adams, a species common at Khandala near Bombay. In Blanford's original description of *Macrochlamys*? *platychlamys*, J. A. S. B. vol. xlix. pt. 2, 1880, pl. ii. fig. 9, from Bombay, he says, "This shell is common in the island of Bombay and neighbouring lowlands on the west coast of India"; and he goes on to mention No. 3, which "appears undistinguishable," also No. 2 from the ancient town of Champanir, near Broach, and says they "may very possibly be a variety of *M. platychlamys*. The specimens are larger than the Bombay types, an adult measuring 16 mm. by 14 mm. in its two diameters, and some individuals attain even greater dimensions; the mouth, too, is rather more convex beneath, but otherwise the two forms agree very closely."

I do not consider No. 3 from the Wynaad to be the same as the type from Bombay, but the single full-grown shell is not in a sufficiently good state to say much about, and no doubt Col. Beddome has other specimens in his collection. As to No. 2,

there is no doubt in my mind it is quite a distinct species, and it is interesting to know my friend Blanford thought so too, and was struck by its greater size, yet hesitated to give it a name. Blanford had noticed the difference in the animals of these Western Peninsula forms as compared with *Macrochlamys* of Bengal; he describes it well; from conversations with him, I know the description applied to the Bombay and typical form. This was confirmed when I received specimens in spirit from that place, kindly obtained for me by Mr. Phipson, by which means I was able to describe the anatomy, and place it in a new subgenus, viz. *Eurychlamys*. vide pp. 90 & 91, Pl. IX. Blanford certainly considered the animal of the Broach shell to be like that of the Bombay *platychlamys*, or he would not have referred it as a variety, and he may even have seen the animal of both. There is considerable likeness in the shells, and I therefore place the shell in the genus *Eurychlamys*, and name it after its collector.

EURYCHLAMYS BLANFORDI, n. sp. (Plate CXXVII. fig. 2.)

*Locality*. The old city of Champanir, near Broach, Baroda (*W. T. Blanford*).

Shell perforate, depressedly conoid, polished, less so in adult shells; flat on basal side, umbilical depression small and contracted; sculpture none, a glassy surface; colour umber-brown; spire slightly elevated, apex rounded; suture well marked; whorls 6, very regularly increasing; aperture narrow and broadly lunate, broader than high; peristome thin, simple; columella not reflected, very oblique.

Size: maj. diam. 17·0, min. 15·5; alt. axis 6·5 mm.

Animal not yet seen, in all probability like that of *Eurychlamys platychlamys* of Bombay, of which Mr. W. T. Blanford considered it a variety (*vide* J. A. S. B. 1880, p. 195). The largest specimen of this which I have seen measures 12 mm. in greatest diameter, most are generally about 10.

Among the land shells preserved in spirit, collected by Dr. N. Annandale in Southern India in November 1908, the one of great interest is William & Henry Blanford's species *Helix todarum*, first obtained by them near Pykara and Neddiwuttom in the Nilghiri Hills, and described in J. A. S. B. vol. xxx. (1861) p. 353, pl. i. fig. 8. In Mr. Blanford's collection (which he bequeathed to the Natural History Museum) are the type shells from the above localities; on same glass slip are 3 smaller shells from Sagur Ghat and Ooty; these Blanford distinguished in his Catalogue, noting that they were "perhaps different." I can see no difference, and consider them young—5½ whorls to 6—the small specimens have rather a flatter spire. Annandale's specimens from Travancore, though small, agree with the figure quoted above. In the Fauna of British India, Mollusca (1908) p. 136, this species is placed in *Macrochlamys*, so it is considered by Blanford in the

description from life in his Field Note Book. It must be remembered that in 1861 only a few Indian species had been examined externally, of not one was the internal anatomy known; neither is it easy in life, when the animal is swollen, exuding mucus, and on a hasty examination, to take in the form of the shell-lobes, which is now done for the first time.

EURYCHLAMYS TODARUM, W. & H. Blf. (Plate CXXVII. figs. 1–1 *d*.)

W. & H. Blf. (*Helix*) J. A. S. B. xxx, 1861, p. 353, pl. 1. fig. 8; Pfr. (*Helix*) Mon. Hel. v. 1868, p. 106; H. & T. (*Helix*) C. I. 1876, pl. 64. figs. 4, 5; Nevill, *Nanina* (*Macrochlamys*), Hand-l. i. 1878, p. 26.

*Macrochlamys todarum*, Faun. Brit. Ind., Moll. p. 136.

"Shell subobtectly perforate, subturbinately depressed, thin, smooth, polished, minutely and closely striated concentrically (longitudinally) throughout beneath the microscope, rufescent brownish horny; spire conoid, apex acute, suture impressed; whorls 6, convex, the last considerably broader, rounded at periphery, convex below; aperture subvertical, roundly lunate; peristome thin, basal margin slightly arcuate, columellar curved, vertical above, triangularly reflected partially covering the perforation.

"['Animal of Nilgiri specimen very similar to *H. vitrinoides* (i. e. *M. indica*, *petrosa*, &c.), and with precisely similar linguiform processes to the mantle. Back very narrow but not keeled above. Animal and mantle black.'—*Extract from Dr. Blanford's Note-book.*]

"Maj. diam. 14, min. 12, height $7\frac{1}{2}$ mm.

"*Hab.* Nilgiri Hills; Pykara, Neddiwuttom, 6000′, &c. Also reported from other parts of the Nilgiris, from Tinnevelly and from the Shevroys."

*Locality.* Tenmalai, Western Ghats, Travancore (*N. Annandale*).

Animal (figs. 1 *a*, 1 *b*) of a very blue-black colour throughout; sole of the foot divided, the central area very pale, contrasting strongly with the very dark margins; a large lobe above the mucous pore; peripodial margin closely fringed, the peripodial grooves above, the furrows leading from them to the rounded keel of the foot wide apart, the intervening surface of the integument rather smooth; the thin wall of the branchial sac indigo-blue, the veins conspicuous being bordered by thin black lines. The right shell-lobe is moderately long, given off from below the upper inner angle of the aperture, it is thin and smooth, and elongately leaf-like when expanded, not at all like that of *Macrochlamys*, which is narrowly tongue-like tapering to a point and crossed at right angles by lines of its muscular contraction. The left shell-lobe is much broader and leaf-like, smooth, not in the least papillate. The right dorsal lobe is small; the left is in two parts, close adjacent, the anterior small, the posterior narrow.

The jaw has a central projection as in Pl. LXXXIV. fig. 2 *e* (*E. regulata*). The radula was extracted complete, and has the formula :—

52 . 2 . 12 . 1 . 12 . 2 . 52
or 66 . 1 . 66.

It is thus identical with that of *Eurychlamys regulata* of Ceylon; the form of the teeth is the same. There was so great a similarity, in this and other respects, that I was led to make a comparison of the shells. It was fortunate the shell of *E. regulata* I had dissected had been preserved: it showed the Travancore shell to be quite different in shape and in its coloration, viz., a ruddy brown colour. The generative organs of this specimen were not in a good state of preservation, being much contracted together, but from what was seen they were like those of *E. regulata*. In the external character of the foot, the two species differ considerably: compare figure 2, Plate LXXXIV. of *regulata*, and figure 1, Plate CXXVII. of *E. todarum*.

In a second specimen dissected, also from Tenmalai, I was fortunate to get out the genitalia, with only the spermatheca broken off; there is no amatorial organ. The male organ (Plate CXXVII. figs. 1 *c*, 1 *d*) is of the type in *Eurychlamys*—stouter than in either *platychlamys* or *regulata*. It has a bulbous head where the vas deferens joins, this is extremely short and crenulate next the prostate. At the base of the penis-sheath is a short sac-like diverticulum (*cæ*) with the free end directed downwards; having only one specimen to mount, I did not cut it open to examine it; on the side of the penis-sheath, just above the cæcum there is a strong muscle (*m*).

## Austenia.

(*Continued from* Vol. II. p. 174.)

For description of typical species of the genus, see p. 228, Vol. I.

Austenia resplendens, Nevill. (Plate CXXX. figs. 2–2 *f*.)

Nevill (*Helicarion*), J. A. S. B. xlvi. 2, p. 23 (1877); id. Yunnan Exped., Moll. p. 883, pl. 80. figs. 6, 6 *a*; id. J. A. S. B. l. 2, p. 129, pl. 5. fig. 24 (1881) (shell); Nevill, *Helicarion* (*Austenia*), Hand-l. i. p. 16 (1878); G. Tapp. Canefri, Ann. Mus. Civ. Gen. xxvii. p. 315 (1889); Faun. Brit. Ind., Moll. (1908), p. 194.

*Original description* :—"Shell in texture and colour resembling *Helicarion gigas*, Bens., but a little thinner and more membranaceous; it is distinguished from it by its flattened, more ear-like, and appressed shape. It also somewhat resembles *Helic. peguensis*, Theobald, J. A. S. B. 1834, p. 8, from Prome *; it is, however, a larger thicker shell, with the whorls of the spire much broader and more distinct, and considerably less open at the base;

* There is some mistake here. *Vitrina peguensis* was described as from Pegu, J. A. S. B. 1864, p. 244.

in many respects it is intermediate between the above two species, though all three are easily recognisable and quite distinct.

"Type of *Helic. resplendens*, diam. max. 22, lat. 14, crass. 8 mil.

"Four specimens of this interesting form were found at Sawaday. Dr. Anderson also brought back a single specimen (in spirit) from Bhamô (5000 ft.) which clearly shows the animal to be of a light pinkish colour, very sparsely dotted with black specks, except on the mantle-lobes and caudal extremity, which are thickly dotted; in this specimen the spire of the shell only is covered by the animal, though the mantle-lobe has no doubt shrunk."

Owing to the kindness of Mr. N. Annandale, the present Superintendent of the Indian Museum, I have received the type specimen of *A. resplendens*, Nevill, preserved in spirit by Dr. John Anderson. I had never seen this animal before, but it has enabled me to identify a specimen collected in 1899 by Mr. Wm. Doherty, at the Ruby Mines in Upper Burma, as the same species. The shell has been removed from the type-specimen, but it could not have been more than 17 mm. in major diameter, and is therefore young. The shell of the Ruby Mine specimen is 26·5, larger than the type shell recorded by Nevill to be 22. The anatomical details will be made from the Ruby Mine specimen, so there will be no necessity to touch the type, which goes back to the Indian Museum, Calcutta.

It is a true *Austenia* (animal, figs. 2, 2 *a*), although distinct from *A. gigas*, the type of the genus—outwardly in the coloration—*gigas* being dark coloured greenish grey; *resplendens* being pale ochraceous. The peripodial grooves are much more distinct in *gigas* (*vide* Plate LV. figs. 3, 3 *a*), in *resplendens* they hardly show at all. Interesting difference is found in the shell-lobes in *gigas*, the right is distinctly separate from the left above the respiratory orifice. In *resplendens* (Plate CXXX. figs. 2, 2 *a*) they are united by a narrow band, taking the form of these lobes as presented in *Girasia*, for even a short cicatricial line is visible—thus *resplendens* shows a most remarkable approach and link with *G. magnifica* of Yunnan (Pl. LVI. figs. 1–5 *a*). The left shell-lobe laps well over the edge of the peristome, and is continuous to the posterior margin where it unites with the right shell-lobe. The foot is very short behind, much shorter than in *A. gigas*, the extremity truncate, with a linear gland; the major portion of the foot as far back as that situated below the apical portion of the shell contains the internal organs of the animal. On removing the shell, the visceral sac is seen to end in a short curved hook (fig. 2 *f*), the last remnant of a more pronounced coil in the progenitors of this genus.

In order to better preserve this rare specimen the different parts of the generative organs were removed separately, and they were in a perfect state of development. They are similar to those of *A. gigas*, somewhat more attenuate. In the male organ (fig. 2 *c*) the main sheath from the generative aperture is a very

long tube, with a swollen portion and a sharp band, held together by muscular tissue. At the head is a short cæcum-like process to which the retractor muscle is attached; the epiphallus (*ep.*) is short, so is the kalc-sac (*k*). The amatorial organ (fig. 2 *d*) is large and cylindrical, the distal end was so tightly embedded in the albumen gland, that I could not separate the two, due to contraction and hardening in the alcohol.

The spermatheca is very long (fig. 2 *b*) and was folded on itself, its walls were quite thick and strong. The folding was due to the presence of a single perfect spermatophore (fig. 2 *c*), very beautiful in form, an elongate capsule, not so long as in *A. gigas*, also with a shorter flume, with strong bifid spines at base of the capsule and finer longer ones at base of the flume. Total length 20 mm., of which the capsule is 7·5 mm.

Adjacent to where the prostate merges into the vas deferens (fig. 2 *b*) there are a pair of sacculate bodies (*s*), apparently the oviduct terminating in this way.

The radula is precisely the same as in *A. gigas*, even to the formula, which is

50 . 3 . 22 . 1 . 22 . 3 . 50
or 75 . 1 . 75.

The only difference is in the marginal teeth, but the radula was not quite perfect along the whole side. The jaw has a central projection. For radula of *A. gigas* see Vol. I. p. 232 and Plate LXII. fig. 8.

Austenia annandalei, n. sp. (Plate CXXVIII. figs. 15, 15 *a*; Plate CXXX. figs. 1–1 *d*.)

*Locality.* Siliguri, North Bengal (*N. Annandale*).

Shell rudimentary, flatly spatulate, membranaceous, thin; sculpture none; colour pale ochraceous near apex, merging into dark brown on the margin, within dull white with dark margin; spire quite flat, the apex is somewhat more shelly, but was not perfect; whorls only one, hardly any coil.

Size: maj. diam. 22·0, min. 13·0; length of animal 48 mm.

Only a single specimen was found, the animal of which had hardened very much in the spirit, so that in the drawing (Pl. CXXX. fig. 1) the mantle appears very much contracted, but there is an indication that even in life a larger surface of shell would be exposed than is seen in *Girasia hookeri*, and other Assam species of that genus.

The shell is not quite so rudimentary as in the above type species and is broader in proportion to the length, in fact approaching more to the form of the shell in *Austenia gigas*; there is also a decided terminal point and coil of the visceral sac which is lost in *Girasia hookeri*. It is an interesting and a linking species in this series of slug-like molluscs.

The colour in alcohol is very black, particularly on the foot and dorsal lobes, the combined shell-lobes are much paler, but the head

is of the same dark colour, probably a very dark grey in life; the left dorsal lobe is faintly papillate and closely mottled black. The peripodial margin is streaked with black, giving it the same fringed appearance as is seen in *A. gigas*. The keel of the foot is very sharp and continuous to the posterior side of the visceral mass. There is no V-shaped depression so typical of true *Girasia*, *vide* Plate LV. figs. 1, 1 *a*, 1 *b*, and Plate LIX. figs. 1, 1 *a*, 1 *b*, & 2, 2 *a*; and this species must be placed in *Austenia* on the ground of the form of the animal being more important than the form of the shell, although in the more fully developed shell-lobes it shows an approach to *Girasia*. The mucous gland is linear; the foot has a central area.

Length of the animal 48 mm.

The different parts of the generative organs were so hard and pressed together that it was most difficult to extract them entire; the amatorial organ is 23 mm. long and cylindrical, the spermatheca very long, and on the whole the genitalia are similar to those of *A. gigas*.

The male organ displayed the position of a spermatophore passing down it to the generative aperture (fig. 1 *c*), and lying within the sheath; showing clearly that the flume is the first part to be extruded.

The spermatheca contained some five spermatophores (fig. 1 *d*); they were much pressed and agglutinated together, so that only by patient soaking was it possible to disentangle them; they resemble my description and drawings of this organ of the type species of *G. hookeri*, Vol. I. p. 220; P. Z. S. 1880, pl. xxvi. figs. 8, 8 *a*; Vol. II. Plate LXXXVIII. figs. 1, 1 *a*. The capsule is about 12 mm. in length, the flume about 6 mm. The position of the spiny plumes is at the base of the capsule, none were seen at the base of the flume as in *Mariaella*, Vol. II. Plate XCIII. fig. 1 *b*, p. 114.

The jaw (fig. 1 *a*) differs much from that of *A. gigas*, being much straighter in front and not so solid, it is thin and transparent.

The radula (fig. 1 *b*) is interesting from the great number of teeth in the row. It is 6·25 mm. in length and 3·5 mm. in breadth, and was got out entire. There are 145 rows of teeth, and the formula is

104 . 1 . 22 . 1 . 22 . 1 . 104
or 127 . 1 . 127.

The central and admedians are elongate on rather narrow plates, the latter with a small cusp low down on the outside, at the 22nd tooth this cusp is larger and at the 23rd is higher, until at the 24th the tooth is nearly evenly bicuspid, and this shape is continued to the margin. It will be seen that in respect to the number of admedian teeth, the formula agrees with that of *A. gigas*; in total number there are some 60 more, and the lateral teeth are more uniform in shape.

This is an interesting form showing, as it does, how exceedingly close and indefinite is the line separating the genus *Girasia*, with its very degraded shell, from *Austenia*.

Austenia rotunda, n. sp. (Plate CXXX. figs. 4–4 *f*.)

*Localities.* Cachar (1) (*J. Wood-Mason*), Silchar (2) (*F. Ede*).

Shell flattened oval, membranaceous, old shell fairly solid, surface shiny; sculpture none; colour pale chestnut, bright straw-colour when young; spire very depressed; suture shallow; whorls 2, apex white, expanding rapidly; aperture flatly oval; peristome extremely thin, a mere membrane; columellar margin very thin, curved.

Largest specimen, size: maj. diam. 24·5, min. 16·5; height of shell 7·5 mm.

Smaller figured and dissected: maj. diam. 16·0, min. 11·0 mm.

The shell (1) (figs. 4 *b*, 4 *c*) differs from *A. gigas* in being more tumid and apex more coiled, and from *A. resplendens* by the apex being broader and not so closely wound and more symmetrically oval. A closely allied species is *A. butleri*, but a comparison of the figure of this species on Plate XC. fig. 5 of this volume, shows how much more elongate it is and how the spire is coiled in a different way. The species now described is peculiarly roundly oval in shape.

The animal (figs. 4, 4 *a*) is pale ochraceous in spirit with no markings on any part, the foot is very short behind; the right shell-lobe is a broad rounded flap, the left shell-lobe is continuous with it and overlaps the peristome all round, ending near the keel of the foot. The peripodial margin is narrow, the groove above it strong, the next above irregular and not so well defined. The right dorsal lobe is small, the left very well developed.

Of the shell of this specimen (2), which is not mature, I give drawings (fig. 4 *d*) enlarged and (fig. 4 *e*) natural size. I also give a figure of the visceral sac when this shell was removed, the last remnant of the visceral coil is well seen.

There is a colour variety, having black streaks on the peripodial margin and spotted on extremity of foot.

## Genus Girasia.

(*Continued from* Vol. II. p. 108.)

A *Girasia* in every respect similar in form to *hookeri* of the Khasi Hills, ranges far eastward, and was sent me by Mr. M. Ogle from the Diyung Valley, Singpho Hills. It is 50 mm. in length as contracted in spirit. Pale ochre, finely mottled all over with pale grey, the peripodial margin fringed with same colour. I distinguish it as var. *maculosa*.

*Girasia cacharica*, Vol. I. p. 240, was also sent me by Mr. Ogle from the first high range between Cachar and Munipur.

## Genus Cryptosoma.

(*Continued from* Vol. II. p. 54.)

Faun. Brit. India, Moll. (1908), p. 209.

Cryptosoma khyoungensis, Godwin-Austen. Shan Hills.

*Austenia? khyoungensis*, G.-A. P. Z. S. 1888, p. 241.

Faun. Brit. Ind., Moll. (1908) p. 211, as a synonym of *Crypto soma præstans.*

I have very recently seen a specimen attributed to this species in Mr. G. K. Gude's collection. It contained the dried-up animal, so I took it away and soaked it out. *C. khyoungensis* occurred among a batch of shells from Upper Burma which I had received from Mr. John Ponsonby, they had been collected by Captain Spratt, R.A. Mr. Gude informed me he had purchased it at Stevens's Auction Rooms, out of a lot of duplicate shells sent there by Mr. John Ponsonby. The result of the soaking showed the foot and markings very distinctly, with the shell-lobes, but the generative organs were gone. The radula was complete, almost as broad as long, and showed a formula different from that of *C. præstans*, viz.:

166 . 1 . 11 . 1 . 11 . 1 . 166
or 178 . 1 . 178.

In *C. præstans* from Moulmain, described in Vol. I. p. 16, the formula is:

120 . 2 . 7 . 1 . 7 . 2 . 120
or 130 . 1 . 130.

The laterals being thus far fewer in number.

In the central and admedian teeth the basal cusps are very much suppressed, in *C. præstans* they show larger (Plate IV. fig. 12); the laterals are much curved, on narrow plates, with evenly bicuspid points, very small on the margin.

The jaw is simple, straight, slightly concave on the cutting-edge with no central projection.

Shell: maj. diam. 14·5, min. 11·5; alt. axis 6 mm.

Surface like rough paper with microscopic close-set dots in relief.

*Original description*:—"Shell globose, tumid, not umbilicated; sculpture covered with an epidermis, smooth; colour brown, but the specimen with epidermis still remaining is weathered, in life it is probably polished; spire low, apex rounded; suture shallow; whorls 3, the last ample and convex on periphery; aperture nearly circular; peristome thin, a strong callus on the body-whorl extending into the interior of the shell.

"Largest specimen.—Size: maj. diam. 20·5, min. 12·0; alt. axis 9·0 mm.

"Second specimen.—Size: maj. diam. 18·0, min. 13·75; alt. axis 6·8 mm.

"Animal not seen. It would be an interesting species to obtain alive.

"This is one of those forms which, without an examination of the animal, it is quite impossible to assign to its true generic or subgeneric position." The great number of teeth in the radula shows it is not an *Austenia*.

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## Subfamily DURGELLINÆ.

### Genus DURGELLA.

(*Continued from* Vol. II. p. 205, 1907.)

DURGELLA EDEANA, n. sp. (Plate CXXIII. fig. 12, type (shell); Plate CXXIX. figs. 2, 2 *a*.)

*Locality.* Silchar, Cachar (*F. Ede*).

Shell very thin and membranaceous, so much so that on drying up, its form was much destroyed and the surface became wrinkled. It consists of 3 whorls, the last large and rapidly increasing. Colour a dark olive-brown.

*Animal.* Foot smooth on sides, peripodial grooves close together. Sole of foot narrow, divided. Foot long behind, truncate, with a lobe above the mucous gland.

The jaw (fig. 2) is straight on the cutting-edge, narrow, thin, with slight trace of an arched upper margin.

The radula (fig. 2 *a*) consists of a multitude of very similar teeth on narrow plates, with a serrated edge. The central tooth is small, unicuspid, the first three or four marginals are slightly broader than those that follow.

Only one specimen was obtained, and that by Mr. Ede, after whom I have the pleasure of naming it.

DURGELLA? ERRATICA, G.-A. (Plate CXXXI. figs. 2, 2 *a*.)

(? *Austenia*) G.-A. P. Z. S. 1888, p. 241.

*Nanina levicula*, Blf. J. A. S. B. 1865, pt. 2, p. 87; Nevill, Hand-l. i. p. 26, no. 56, 16 Bassein (*W. T. Blanford*); nec Bs.

*Durgella erratica*, Faun. Brit. Ind., Moll. (1908) p. 216.

*Localities.* Pingoung, Shan Hills, Burma, type (*Spratt*): Bassein district, Pegu (*W. T. B.*).

Description by Dr. W. T. Blanford:—

"Shell openly perforate, globosely depressed, thin, translucent, smooth, slightly polished, pale amber or brownish; spire nearly flat, slightly convex, suture shallow; whorls 3½–4, rapidly increasing, flatly convex above, the last much larger, scarcely

descending in front, rounded at the periphery, convex beneath; aperture oblique, diagonal, ovately lunate; peristome thin, upper margin slightly depressed, columellar oblique, reflected."

The specimen figured is one from Bassein in Blanford's Collection, now in the B.M. Collection. The type from Pingoung was presented to same Museum by Mr. John Ponsonby.

I said in 1888, it is not like *levicula*, which has a very thin and glassy shell, is much more globose, and with a higher spire. I put it only provisionally in *Durgella*. The distinct umbilication is unlike any shell of this type I have seen.

Size of shell figured: maj. diam. 8·8, min. 7·4; alt. axis 4 mm.

## Genus Leptodontarion.

(*Continued from* Vol. II. p. 208.)

Leptodontarion tavoyensis, n. sp. (Plate CXXVII. figs. 3–3 *e*.)

*Locality.* Tavoy, Tenasserim (*Captain Stanley Flower*).

*Animal* (figs. 3, 3 *a*). Foot throughout grey-green, the shell-lobes black. Foot with a long overhanging lobe; peripodial margin well defined, *three grooves above it*; the head is depicted contracted under the edge of the left dorsal lobe. Sole of foot (fig. 3 *b*) has a narrow central area, well defined from the two narrow areas on either side; the mucous pore is underneath the overhanging portion and reaches to the tip of it. The left shell-lobe broad and pointed behind, the right also broad and square behind.

Length of animal 15·5; shell, maj. diam. 7·5 mm.

Jaw (fig. 3 *d*) slightly arched, no central projection, thin and delicate.

The radula (fig. 3 *e*) is very broad, apparently nearly as broad as long, with a very great number of very close-set teeth, all of the same shape, becoming gradually smaller on the outer margin; unfortunately the radula is folded up, and when once this occurs it is almost impossible to flatten it out without still further destruction, the whole is so small and so fragile, thus I could not find the central tooth. The teeth are on elongate narrow plates, bicuspid, one cusp slightly longer than the other; very similar to those of *L. minuta*, G.-A., of the Dafla Hills. There are probably more than 600 teeth in the row.

Genitalia (fig. 3 *c*): only the male organ and amatorial organ secured, the former is of simple form, bent on itself at the retractor muscle, the latter is short, thick and pointed.

The shell is very thin and membranaceous, of a burnt-sienna colour, globose in form; surface smooth. Whorls 3, increasing regularly, the last tumid.

### Genus Sakiella, G.-A.

In Vol. I. Plate XIX. figs. 7, 7 *a*, 7 *b*, I figured the mantle-zone, extremity of the foot, and jaw of *Macrochlamys honesta*, from specimens from Mulé-it, Tenasserim; the generative organs had not then been seen in a sufficiently good state for delineation. In the 'Fauna of British India' (Mollusca), 1908, p. 237, fig. 79, I figured the teeth of the radula from the same specimens and wrote as follows: "The species *honesta* was included in *Macrochlamys* by Dr. Blanford. I have placed it in a new genus, *Sakiella*, following Stoliczka, who considered it sufficiently distinct to put it in the genus *Durgella*, the anatomy of the type of which, *levicula*, was not then known and which differs materially."

Type, *S. honesta*.

*Range*. Pegu and Tenasserim.

Sakiella honesta, Gould. (Plate CXXI. fig. 12.)

Gould, (*Helix*) Proc. Bost. Soc. N. H. ii. 1846, p. 99; Pfr. (*Helix*) Mon. Hel. i. 1847, p. 57; iv. 1859, p. 63; vii. 1876, p. 19; Blf. (*Nanina*) J. A. S. B. 1865, 2, p. 87; Stol. *Macrochlamys* (*Durgella*) J. A. S. B. 1871, p. 248, pl. 17. figs. 6 & 6 *a*; H. & T. (*Helix*) C. I. 1876, pl. 90. fig. 10; Nevill, *Nanina* (*Macrochlamys*), Hand-l. i. 1878, p. 24; Godwin-Austen, Moll. Ind. i. 1883, p. 142, pl. 19. figs. 7–7 *b* (details of animal); v. Mart. *Nanina* (*Durgella*) Jour. Linn. Soc. xxi. 1889, p. 162.

Faun. Brit. Ind., Moll. p. 238.

*Original description*:—"Differs from *Macrochlamys* in the form of the teeth of the radula and the formula, the number of teeth in the row being three times as numerous. The shell has the aperture peculiarly oblique. The shell-lobes are as in *Macrochlamys*. The genitalia have not been satisfactorily worked out owing to lack of material properly preserved."

After pointing out that *Macrochlamys honesta*, var. *andersoniana*, Nevill, is a distinct species, I described the animal of *honesta* as follows:—

"The animal (three specimens observed) from Mulé-it Mountain near Moulmain is pale-coloured, a dark line on the upper side of the foot, with three or four conspicuous black spots on the side, above the peripodial grooves; these spots when extended in life would appear as dark streaks. The right shell-lobe is long, narrow, and pointed, and there is a small tongue-like left shell-lobe. The visceral sac is spotted, the spots arranged in four parallel rows. The genitalia were not well seen, but the amatorial organ was present, and the spermatheca was not very long. The jaw is moderately arched, with no median projection. The radula is remarkable for the very large number of teeth in the row. The centre tooth is on an elongate narrow plate, tricuspid; the first admedians on similar plates, with a single small cusp much

below the points; the laterals are all alike, becoming smaller towards the margin and unevenly bicuspid; the formula being 153 . 1 . 153, or 307 in the row. The jaw and radula are quite distinct from Stoliczka's figures on plate 17. figs. 10 and 14, J. A. S. B., and Semper's pl. 5. fig. 20, Reis. Phil. 1870."

The shell figured is in the Indian Museum, Calcutta, No. M. $\frac{3673}{1}$, but has no locality in the tube. No. M. $\frac{3674}{1}$ is written against "2 Pudupyoo (Upper Burma), coll. J. Anderson," and is the third species enumerated in Hand-list, p. 24, under var. *andersoniana*, G. Nevill. These two specimens are very young shells, not identifiable unless a series was collected at the same place. In the tube with them is a ticket with "Burma types" in Nevill's writing, and on a piece of paper loose in the box is written "*N. philumbrina*, Nev. Pudupyoo, U. Birma. Type."

I am now able to describe another species of the genus.

Sakiella merguiensis, n. sp. (Plate CXXVIII. fig. 16, shell; Plate CXXIX. figs. 1–1 *d*.)

*Locality*. Mergui (*Wm. Theobald*).

Shell umbilicated; sculpture none, a smooth rather shiny surface, transverse oblique lines of growth conspicuous; colour pale horny; spire depressedly conic, apex blunt; suture shallow; whorls $5\frac{1}{2}$, subangulate on the periphery; aperture semi-lunate; peristome thin; collumellar margin suboblique, not reflected, but somewhat thickened into a sinuate pillar.

Size: maj. diam. 16·5, min. 14·5; alt. axis 7·5 mm.

*Animal*. Dark ochraceous with black markings, three black spots on side of the foot (fig. 1); the branchial sac from the black-bordered mantle-zone has longitudinal parallel black bands, and spots of same colour. The mucous gland large. Sole of foot divided. The peripodial margin is broad, bounded above by three peripodial grooves, the sides of the foot broken up into a fine papillate surface. The right shell-lobe (fig. 1 *a*) narrow elongate, the left much smaller. The left neck-lobe in two distinct parts: the anterior small, quadrate, black; the posterior very narrow and at some distance from the other.

The radula was broken up on dissection, but several portions with the central teeth were secured (fig. 1 *d*). The centre tooth and three on either side have plates, the longest and broadest in the row, they are succeeded by a very large number on much narrower plates which are long, curved, and bicuspid.

A radula quite after the type of the *Durgellinæ*, next to which this genus should be placed.

The jaw (fig. 1 *c*) is moderately arched, even in breadth, concave on cutting-edge, no projection.

*Genitalia* (fig. 1 *b*). There is no amatorial organ. The penis is a long tube swelling towards the retractor muscle, bent on itself and becoming smaller where the above muscle is given off. There is no kale-sac, only a very short bulbous epiphallus where the vas

deferens joins. The spermatheca is short, largely bulbous on a short thick stalk.

This undoubted species of *Sakiella* differs from *S. honesta* in several points, the much larger shell and its different texture, and strong coloration of the animal. It enables me to add the following to the description of the genus :—*No amatorial organ and no kalc-sac to the penis, and the spermatheca short with a bulbous sac;* these characters being quite unlike the same parts in *Macrochlamys*, but may be compared to the anatomy of some species of *Durgella*, and to *Satiella dekhanensis*.

SAKIELLA ? FIDUS, n. sp. (Plate CXXI. fig. 8.)

*Locality*. Thyetmyo, Pegu (*Theobald & Blanford*; ex coll. Calcutta Museum, No. M 3676 *b*).

Shell narrowly perforate, much hidden by reflected columella, globosely conoid ; sculpture, very fine close microscopical striation on the last whorl, strongly striate within the perforation ; colour very pale, with a bluish tinge ; spire conic, sides nearly flat, apex subacute ; suture moderately impressed ; whorls 5, increasing regularly, last whorl rounded ; aperture lunate, oblique ; peristome rather thickened ; columellar margin oblique.

Size : maj. diam. 10·5 ; alt. axis 4·5 mm.

Two specimens were found among ten shells, catalogued in Nevill's Hand-list, p. 24, no. 43, *Nanina* (*Macrochlamys*) *honesta*, Gould, from above locality. Seven of these proved to be *M. chaos*, W. T. Blf., one is probably a new species. Although with some characters like *honesta*, the flatness of the sides of the spire and the sculpture mark it as quite distinct.

The occurrence of the genus *Sakiella* at Thyetmyo or any part of Upper Burma has to be verified by specimens preserved in spirit.

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In Vol. I. (1883) p. 70, Plate XV. fig. 6, I described and figured under *Kaliella* ? *nevilli* a shell from Sikkim, saying "its generic position was very doubtful," the form being pyramidal and keeled, and there being no other genus for its reception, *Kaliella* with a doubt was selected. Recently, in the 'Fauna of British India' (Mollusca), vol. i. (1908) p. 274, Blanford gave it the same generic position, remarking "the relations of this shell are very doubtful. It cannot be a *Kaliella* to judge by the shell." I have lately found another species possessing very similar shell-characters from the Patkai Range, Assam, and although the animal remains unknown, and even its true family position, it is time a genus should be formed to separate it from *Kaliella*.

Genus PSEUDOKALIELLA, gen. nov.

Shell umbilicated to openly umbilicated, subturbinate ; whorls rather rapidly increasing, thin, subcostulate ; periphery ornamented with hairs, either pointed or blunt ; spire subconoid.

Type, *P. nevilli*, G.-A., Sikhim.

I figure the peripheral hairs of *P. nevilli* (Pate CXXXI. fig. 12) much enlarged, they are finely pointed and rise from, and are an expansion of, the subcostulate rib. In *P. ornatula* (fig. 9 *b*) a similar expansion of the rib is rounded off, becoming of flange-like semicircular shape.

PSEUDOKALIELLA ORNATULA, n. sp. (Plate CXXXI. figs. 9, 9 *a*, 9 *b*.)

*Locality.* Maiam Peak, Patkai Range (*M. T. Ogle*).

Shell openly umbilicate, depressedly pyramidal, thin, covered with an epidermis; sculpture fine, regular ribbing, some of the ribs expanding on the keel into a small flange, the ribbing is continuous on the basal side but finer; colour dull ochraceous; spire low, sides flat, apex rather sharp; suture shallow; whorls $5\frac{1}{2}$, regularly increasing; aperture semilunate; peristome thin; columellar margin not thickened, oblique.

Size: maj. diam. about 12·0; alt. axis nearly 6·0 mm.

Only two specimens of this striking little shell were found, and both are unfortunately imperfect, so the dimensions were taken from the drawing. Other species may be expected to be found in the mountain region north and east of Assam.

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## Genus SARIKA.

(*Continued from* Vol. II. p. 182.)

SARIKA THEODORI, Phil.

(*Helix*) Zeitschr. Mal. 1846, p. 191; Pfr. (*Helix*) Mon. Hel. i. 1848, p. 70; vii. 1876, p. 122; H. & T. (*Helix*) C. I. 1876, pl. 59. figs. 7, 8; (*Hemiplecta*) Faun. Brit. Ind., Moll. 1908, p. 292.

Blanford described it as follows:—

"Shell openly perforate, depressed, sublenticular, pale yellowish tawny, rather thin, subcostulately striated, the striæ decussated by spiral (longitudinal) impressed lines; spire low, apex obtuse, suture impressed; whorls $6–6\frac{1}{2}$, convex above, the last bluntly angulate at the periphery, descending near the mouth in adults, moderately tumid beneath; aperture oblique, almost diagonal, broadly lunate; peristome white, slightly thickened inside, outer margin broadly sinuate, columellar curved, oblique, briefly reflected above.

"Major diam. (of fully grown shell from Ataran) $26\frac{1}{2}$, min. 24, height 13 mm. Another specimen measures $24 \times 21 \times 10\frac{1}{4}$; an immature shell from Mergui $27 \times 23\frac{1}{2} \times 13$.

"*Hab.* Mergui (*Philippi*), Yanglaw, Tenasserim valley; Ataran Valley (*Theobald*); top of Muleyit (*Fea*).

"The type described by Philippi appears to have been immature, as was certainly the shell figured by Pfeiffer in Mart. & Chemn. Conch.-Cab. 2nd ed. no. 687, pl. 110. figs. 1–3. The two specimens obtained by Theobald from Ataran, now in the British Museum, are probably the first adult shells described.

"This species is distinguished from *H. textrina* by much coarser sculpture, descending last whorl, and more oblique and small aperture."

Largest specimen preserved in spirit by Mr. Theobald measures 29·25 × 25 × 10·5 mm.

SARIKA THEODORI, Phil. (Plate CXXIX. figs. 3–3 *c*.)

*Locality.* Mergui (*Wm. Theobald*).

*Animal.* Ochre; an overhanging lobe to mucous gland; the peripodial margin (fig. 3) closely fringed, the parallel grooves close together forming a narrow peripodial line, from which run upwards to the keel of the foot very close-set well-marked regular furrows. Sole not divided. A very small right shell-lobe (fig. 3), below the inner upper angle of the aperture. The buccal mass has a very powerful solid muscle, given off from the basal side; the salivary glands are in one large mass.

The genitalia (fig. 3 *a*) were not at full maturity. There is an amatorial organ with a blunt termination; the male organ has no cæcum near the retractor muscle, the epiphallus is short with a very elongate kalc-sac where the vas deferens joins; the spermatheca is short.

The radula (fig. 3 *c*) was not extracted complete, but enough was seen to show the formula to be

$$+25 \ . \ 18 \ . \ 1 \ . \ 18 \ . \ 25+$$

The marginals were quite broken up. The central tooth is on a quadrate plate with side cusps, the admedians have a single cusp on the outer side, at the 16th, 17th, and 18th this is small and low down, but gradually rises towards about the 28th, until at the 38th and onwards the teeth are very nearly evenly bicuspid.

The jaw (fig. 3 *b*) is very solid, arched, and with a central projection.

The teeth of the radula are like those of *Sarika resplendens*, the genitalia are also quite on the same plan. The regular, closely wound shell is of the same type.

In the 'Fauna of British India' (Mollusca) this species was placed in *Hemiplecta*, together with *H. textrina*, Bs. and *H. gordoniæ*, Bs.; both from this part of India, the former ranges to Prome and Thyetmyo in Pegu. Both species I consider should be better placed in the genus *Sarika*.

## Genus Euplecta.

(*Continued from* Vol. II. p. 104.)

### Euplecta phideas, Thorp MS.

*phidias*, Thorp MS. apud Hanley (*Helix*), H. & T. C. I. 1876, p. 59, pl. 149. fig. 4 (no description).

Faun. Brit. Ind., Moll. p. 71.

*Animal.* From a specimen from Kandy sent me by Mr. O. Collett. Foot pale ochre with a dark patch on side of the neck, the overhanging lobe at extremity of foot conspicuous. The left dorsal lobe not divided, a mere narrow strip; peripodial margin broad, fringed, and paler than the part above, the peripodial grooves very close together.

In the genitalia the male organ with a distinct loop as in larger forms of the genus; amatorial organ large.

Jaw very strongly arched with no central projection.

Radula with the usual central admedian and a large number of lateral teeth, all evenly bicuspid and becoming very minute on the edges. Formula:

60 . 1 . 16 . 1 . 16 . 1 . 60
77 . 1 . 77.

### Euplecta gardeneri, Pfr.

Mart. & Chemn. (*Helix*) Conch.-Cab. ed. 2, 1846, *Helix*, no. 703, pl. 112. figs. 12, 13; id. (*Helix*) Mon. Hel. i. 1847, p. 47; id. *t. c.* vii. 1876, p. 87; H. & T. (*Helix*) C. I. 1876, pl. 84. fig. 7.

Faun. Brit. Ind., Moll. pp. 40, 64.

*Locality.* In forest, Uva, 5000 ft., beneath fallen leaves (*O. Collett*).

The animal with visceral sac very dark in colour, probably a dark grey in life. The right dorsal lobe ample, the left in two distinct widely separated parts, the posterior long and narrow. A pointed lobe over the mucous gland. No division of the sole of the foot. The peripodial margin narrow, the two grooves above rather wide apart.

In the genitalia the penis is looped up for a considerable length by a strong muscle encircling the penis. The cæcum of the retractor muscle (*cr.p*) is long, and there is shortish blunt kalc-sac. The vas deferens very long; the spermatheca very small and sessile; the amatorial organ very long, nearly of the same diameter for whole length; buccal muscles of great strength.

Jaw curved, with a very slight central projection.

In radula the laterals are evenly bicuspid. Formula:

48 . 1 . 14 . 1 . 14 . 1 . 48
63 . 1 . 63.

Although the shell is so very different to the typical species *subopaca* and *layardi*, this radula conforms in every respect with that of *Euplecta*; the generative organs are also similar.

## Family ENDODONTIDÆ.

(*Continued from* Vol. II. p. 199.)

### Genus Pupisoma.

Pupisoma, Stoliczka, type *P. lignicola*, Stol.

This subgenus was described by Ferd. Stoliczka in the Journ. Asiat. Soc. Bengal, vol. xlii. pt. 2, 1873, p. 32. After referring to the Indian subgenera *Hypselostoma*, *Boysia*, and *Scolpelophila* (type *Pupa kokeilii*, Rossm.), he says:—

"A second small group of *Pupa* which is found in India, Burmah, and the country southward, is characterised by a subconic or ovate shape, composed of three to five whorls, of a thin corneous texture, covered with a transversely striated cuticle; the last whorl is not ascending, the aperture generally edentulous; the columellar lip is externally near its attachment somewhat expanded, mostly covering the umbilical region, while internally at the base it is twisted and occasionally provided with a small tooth.

"I propose for this generic group the name *Pupisoma* and regard as the type of it the Moulmain *P. lignicola*, described in J. A. S. B. vol. xl. pt. ii. p. 171 (1871), plate vii. fig. 3. The animals have very short pedicles and barely a trace of tentacles. They generally live on wood."

Stoliczka describes in the same paper of 1873, *Pupisoma orcella*, pl. iii. fig. 2, from Penang, found on *Cocos nucifera*. "The animal is grey with dusky pedicles, but no perceptible trace of tentacles. The species differs from *P. lignicola* (loc. cit.) by a shorter and broader form, more convex whorls, and by a very slightly expanded and thin outer lip. In fresh specimens some of the transverse striæ of the cuticle are rather stronger than in others, but they soon wear off."

In the subgenus, according to Nevill, in his amended copy of 'Hand-list of the Mollusca in the Indian Museum, Calcutta,' 1878, p. 192, are the following species:—

No. 50. P. lignicola, Stoliczka.

"30. Kangan caves near Moulmain (type), coll. Dr. F. Stoliczka." In same lot from "Moulmain. Unique specimen, a toothed variety—var. *unidentata*"*. Referred to by Stoliczka in his description, p. 172, as follows:—"Out of a great number of specimens only one was met with which has a small tooth about the middle of the inner or parietal lip; its presence, therefore, must be regarded as an exceptional character."

Mr. Hanley has figured a toothed variety, but he does not say from whom he got the specimen.

* Conch. Indica, Plate clx. fig. 6. The colouring is very strong, not at all like any specimen I have seen, very like that of a *Glessula*.

Stoliczka (p. 172) says: "The animal is grey with somewhat darker, very short pedicles and almost obsolete tentacles."

15. Rangoon, coll. Dr. Hungerford.

1. Pegu (type var.), coll. Dr. Stoliczka.

No. 51. PUPA (PUPISOMA) ORCELLA, Stoliczka.

J. A. S. B. vol. xlii. 1873, p. 33, pl. iii. fig. 2.

5. Penang (type), coll. Dr. F. Stoliczka.

20. Penang; *ex* coll. India House Museum.

No. 52. P. ORCULA, Benson.

*Helix orcula*, Benson, A. M. N. H. ser. 2, vol. vi. (1850), p. 251.

15. North-west Bengal, *ex* coll. Dr. F. Stoliczka.

10. Behar (under bark of large trees), coll. Col. G. B. Mainwaring.

10. Lucknow, coll. Colonel Mainwaring.

No. 53. P. EYEZARDI, Blanford, in J. A. S. B. 1881; from Khandala, under bark of trees; figured in Conch. Indica, plate ci. figs. 5 & 6, Singhur Hill (very inferior).

16. Khandala and Poona, coll. W. T. Blanford.

No. 54. P. SERIOLA, Benson.

Ann. & Mag. N. H. ser. 3, vol. ii. (1863) p. 427. Orissa. Type from Orissa.

*Ennea* sp., Blanford, 1861.

? *Papilla* sp. in Nomencl.

6. Darjiling Terai (under bark of trees), coll. Col. G. B. Mainwaring.

6. Nawade, nr. Muddapur, coll. Colonel Mainwaring.

Not in Indian Museum, Calcutta.

*P. miccyla*, described below.

I have also from the Indian Museum a single specimen of another species taken by Mr. Wood-Mason on an Aurantiaceous plant in March 1881, about two miles above Phenchugam, on the banks of the Kooseeara River. It is too imperfect to figure and describe; the form, particularly the apex, differs much from the species now figured, being very tumid and blunt. This record of locality may lead some collector to find it again.

*Shells edentate.*

PUPISOMA MICCYLA, Benson. (Plate CXXXII. fig. 1; another specimen, figs. 1 *a*, 1 *b*, 1 *c* (radula), 1 *d* (jaw).)

*Helix miccyla*, Benson, A. M. N. H. ser. 3, vol. v. p. 384, May 1860.

*Helix miccyla*, Pfr. Mon. Hel. vol. v. p. 53.

*Helix* ——, Conch. Ind. p. 32, pl. cxxix. figs. 7 & 8.

*Pupa miccyla*, Theob. Supp. Cat. (1876) p. 31.

*Pupa* (*Pupisoma*) *miccyla*, Nevill, Hand-list, i. p. 192, 1878.

Original description :—" *Testa imperforata, globoso-conoidea, tenui, striatula, nitidula, fusco-cornea, translucente, spira truncato-conica, sutura impressa, apice obtusissimo*; *anfractibus* 4 *convexis, ultimo globoso, antice sensim descendente*; *apertura lunato-rotundata, obliqua, peristomate acuto, margine dextro arcuato, collari acuto, verticali, cum basali angulum fere rectum efformantes.*

" Long. $1\frac{1}{2}$, diam. 1 mill.

" Habitat ad Matelle.

" Allied to *H. orcula*, B., of North-Eastern India, but smaller, destitute of the peculiar sculpture of that species, and distinguished by its very obtuse apex and by the formation of the columellar lip. It was found by Mr. F. Layard on the bark of an orange-tree near his house at Matelle."

Size of specimen (figs. 1 *a*, 1 *b*), Binoya Estate, Watawala, Ceylon: major diam. 1·1, total length 1·53 mm.

Some years ago I received from Mr. O. Collett, a number of minute shells of three or four species taken upon the bark of Mango trees during the rains, on the Binoya Estate, Watawala, Ceylon, among them a species referable to this subgenus. It is quite of the type of *lignicola* and *orcella* figured by Stoliczka, but it is smaller than *lignicola*, has a greater number of whorls and is more attenuate than *orcella*, while the transverse striæ of the cuticle appear to be more regular. To throw light on the radula I soaked some of them but failed to find one. I therefore solicited Mr. Collett to collect some more, and have lately received a number well preserved in formalin, and am now enabled to give the description of the jaw and radula of this interesting subgenus.

The foot of the animal is short, but it is too small to see any details of its anatomy; as Stoliczka says of *P. orcella*, the tentacles cannot be made out. However, when the minute animal is pressed out between covering-glasses, the eyes are conspicuous, connected with a short dark streak representing the retractor muscle. In life they probably merely reach the surface of the integument.

The radula (fig. 1 *c*) is exceedingly small, it has the formula

$$\frac{8 \;.\; 6 \;.\; 1 \;.\; 6 \;.\; 8}{14 \;.\; 1 \;.\; 14.}$$

The centre tooth is smaller than those on either side, it is tricuspid, the main point long, those on the side basal and wide apart. The admedian teeth are also tricuspid with indication on the 4th and 5th of two cusps on the outer side. The laterals are on long narrow plates, with four teeth alternately long and short. The jaw (fig. 1 *d*), of which I only detected one, out of some five specimens examined, is composed of about eighteen vertical plates, not overlapping each other, each plate being separated by a very narrow clear space. The cutting-edge is sharply defined. Under the highest power it seemed apparent that these plates divided at the base and merged gradually into muscular tissue.

Nearly every animal examined contained three embryonic shells, some in an advanced stage of development, showing the apex of the shell; compared with the parent animal they are very large, and being pale-coloured were very apparent. During the height of the rains they must be extremely prolific, and no doubt are crowded in colonies together, as I have seen some species, such as *Georissa*, &c., in the humid valleys of the Khasi Hills. Mr. Collett took them off orange-trees in September, 1899, in the bungalow garden, on the Binoya Estate.

I would call attention to the jaw and radula of *Pupisoma miccyla* being so similar to those parts of *Philalanka thwaitesii* (Vol. II. Plate CXII. figs. 1–1 *c*), and this has led me to place the genus in the same subfamily *Thysanotinæ*, after *Philalanka*, *vide* p. 188, Vol. II.

It is also of interest, going outside the Indian Region, to note that the same type of jaw and radula is found in the South African genus *Afrodonta*, type-species *bilamellaris*, Melv. & Ponsonby, *vide* Annals & Magazine of Natural History, ser. 8, vol. i. Feb. 1908, pp. 133–135, pl. viii. figs. 2–2 *c*.

Pupisoma cacharica, n. sp. (Plate CXXXII. fig. 4.)

*Locality*. Silchar (*J. Wood-Mason*).

Shell scarcely perforate, globosely conoid, very tumid, corneous; sculpture, spiral striation, crossed by fine close thread-like ribbing; colour pale umber-brown; spire moderately high, conic, apex blunt; suture open; whorls $3\frac{1}{2}$, rapidly increasing, very convex; aperture nearly circular, oblique; peristome thin, columellar margin perpendicular, reflected.

Size: major diam. 1·33; alt. 1·5 mm.

The tube containing some 50 shells was wrapped up in a piece of paper, on which was written the following notes:—"From the branches of a Pepul tree, in scars and other shallow cavities, opposite the Deputy Commissioner's Cutchery, Silchar, 3.4.81. Only one pair of short thick, blunt, sausage-shaped tentacles, at the upper extremity of which the black eye-spots are placed. Animal semitransparent, greyish, milky white below, above grey; retractor muscles of tentacles very plainly visible through integument. No tail-gland." Sent to me for determination by Dr. N. Annandale, from the Indian Museum. The type-shell figured, with the remaining specimens, will be returned to that Museum.

Pupisoma longstaffi, n. sp. (Plate CXXXII. figs. 3, 3 *a* (jaw), 3 *b* (radula).)

*Locality*. Kandy, Ceylon, on palm-tree (*Mrs. J. Longstaff*).

Shell imperforate, very globosely conoid; sculpture, a smooth epidermis, with very fine, somewhat distant costulation; colour

pale brown; spire depressedly conoid, apex blunt; suture impressed; whorls 3, very tumid and well rounded on the periphery; aperture nearly circular; peristome thin; columellar margin thickened and slightly reflected and extending as a callus on to the last whorl.

This shell is more globose than *P. miccyla* and not so high in the spire which tapers more rapidly. It is also costulate as in the *Pupisoma* figured on Plate CXXXII. fig. 2, a single specimen of which was sent to me by Mr. Sykes, and cannot now be found. Mrs. Longstaff writes:—"Numerous on palm, Florence Hotel Garden, Kandy. Animal, body light grey, only one pair of tentacles, dark. Tail pointed."

I was fortunate in seeing the radula in the first specimen I examined. Nothing could be seen of the genitalia. The mantle-zone was simple, with no shell-lobes.

There are not many teeth in the row, only some 15 or 16; all are large quadrate plates. The central tricuspid, the admedians and laterals bicuspid, the inner cusp long, the outer small and basal. The jaw was crumpled up, and being so minute was not well seen, but it appeared to be smooth.

I am much indebted to Mrs. Longstaff for placing this species in my hands, and I have named it after its discoverer.

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At page 241 I referred to species of *Macrochlamys* found in Mauritius. When drawing the shell, and describing the animal of the Cachar form of *M. indica* (p. 264), I thought it a good opportunity, for the sake of comparison, to figure the shell of the animal I described in the Proceedings of the Malacological Society, vol. vi. (1905) p. 320, pl. xviii. figs. i–iv, there referred to as Sp. A, Mauritius. This description shows how similar the anatomy is to the above-named *M. indica*: only a noticeable difference is found in the formula of the radula, which has nearly double as many admedian teeth, and a greater number in the row, viz.:—

46 . 20 . 1 . 20 . 46 or 66 . 1 . 66,

as against 20 . 1 . 10 . 1 . 10 . 20 or 31 . 1 . 31

of the above Indian species. Another species very close to specimen A was taken by Monsieur Dupont in a farm-yard in Port Louis. In this the formula is

24 . 2 . 15 . 1 . 15 . 2 . 24

or 41 . 1 . 41,

a reduction of the admedian teeth. M. Dupont also sent two specimens of a form from the Comoro Islands which I take to be *M. renitens*, Morelet. It was interesting to find it had the same radula formula as the last-mentioned, and that the shells were similar: therefore I consider all three to belong to the Comoro Island form (*M. renitens*). Specimen A, with a larger shell and rather different radula, I describe as follows:—

MACROCHLAMYS RENITENS, Morelet, large var. (Plate CXXXI. fig. 4.)

*Locality.* Mauritius (from Monsieur E. Dupont's garden), 14. ii. 06.

Shell narrowly umbilicated, depressedly conoid, rather flat on base; surface shiny; sculpture strong longitudinal wavy distant striation, showing also on the basal side; colour dull umber-brown; spire depressedly conic, sides flat, apex blunt; suture impressed; whorls 6, regularly increasing, rounded on the periphery; aperture semilunate, subvertical; peristome thin; columellar margin oblique, very slightly reflected near the umbilicus.

Size: maj. diam. 18·0, min. 15·25; alt. axis 7 mm.

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## EXPLANATION OF PLATE CXVIII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*. | *Macrochlamys subjecta*, Bs., × 2·4. | Rajmahal on Ganges. |
| 2, 2 *a*, 2 *b*, 2 *c*. | —— *vesica*, n. sp., × 2·4. | Teria Ghat, Khasi Hills. (Type.) |
| 3, 3 *a*, 3 *b*, 3 *c*. | —— *vesica*, n. sp., × 2·4. | Chatak, Sylhet. |
| 3 *d*. | —— ——, (another specimen). | Do. |
| 4, 4 *a*, 4 *b*, 4 *c*. | —— *vesica*, var. *anomala*, × 2·4. | Maosmai, near Cherra Poonjee, Khasi Hills. |
| 5, 5 *a*, 5 *b*, 5 *c*. | —— *vesica*, × 2·4. | Hengdan Peak, Naga Hills. |

## EXPLANATION OF PLATE CXIX.

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*, 1 *c*. | *Macrochlamys vesica*, var. *oglei*, n., × 4·2. | Brahmakund, Assam. |
| 2, 2 *a*, 2 *b*, 2 *c*. | *Cryptaustenia moyongensis*, n. sp., × 4·2. | Moyong, Khasi. |
| 3, 3 *a*, 3 *b*, 3 *c*. | *Macrochlamys sufflava*, n. sp., × 4·2. | North Cachar. |
| 4. | —— ——, type, × 4·2. | Lhota Naga Hills. |
| 5. | —— ——, × 4·2. | Do., another specimen. |
| 6. | —— ——, × 4·2. | Burrail Range. |
| 7, 7 *a*. | —— ——, × 4·2. | Naga Hills. |
| 8. | —— *lubricata*, n. sp., × 4·2. | Lhota Naga Hills. |
| 9. | —— *sufflava*, n. sp., × 4·2. | Eastern Burrail Range. |
| 10, 10*a*, 10*b*, 10*c*. | —— *andersoniana*, G. Nevill, × 4·2. | Bhamo. |
| 11, 11 *a*, 11 *b*. | —— *lubricata*, n. sp., × 4·2. | Burrail Range, Naga. |
| 12, 12 *a*, 12 *b*. | —— *quæsita*, n. sp., × 4·2. | Do. |

## EXPLANATION OF PLATE CXX.

*Macrochlamys vesica*, n. sp. Ainakhal, Cachar.

Fig. 1. Head with mantle-zone from left side, showing left shell-lobe, &c., × 4·5.
1 *a*. Genitalia, × 4·5.
1 *b*. Ditto of another specimen, × 4·5.
1 *c*. Jaw, × 30.

*Macrochlamys vesica*, var. *oglei*. Diyung Valley, Singpho Hills.

Fig. 2. Genitalia, × 4·5.
2 *a*. The kalc-sac, with spermatophore forming in, × 12.
2 *b*. Radula, some of the admedian and lateral teeth.

*Macrochlamys politula*, G.-A. Singpho Hills.

Fig. 3. Mantle-margin from the front, showing right shell-lobe and dorsal lobes, × 4·5.
3 *a*. Ditto showing left shell-lobe and left dorsal lobes, × 4·5.
3 *b*. Genitalia, part of, × 8.
3 *c*. Jaw, × 24.
3 *d*. Teeth of the radula at different parts of the row, much enlarged.

## EXPLANATION OF PLATE CXXI.

| | | |
|---|---|---|
| Figs. 1, 1 *a*. | *Macrochlamys vesicula*, Bs., × 2·5. | Mussoorie, N. W. Himalaya. |
| 2. | —— *vesica*, var., × 2·4. | Cachar. |
| 3. | —— *garoensis*, n. sp., × 2·4. | Garo Hills. |
| 4, 4 *a*. | —— *kurtzi*, n. sp., × 2·4. | Arakan. |
| 5. | —— *cacharica*, var. *glauca*, × 2·4. | Borpani, Dafla Hills. |
| 6. | —— *rabani*, n. sp., × 2·4. | Chittagong. |
| 7. | —— *proba*, n. sp., × 2·4. | Thyetmyo, Burma. |
| 8. | *Sakiella ? fida*, n. sp., × 2·4. | Do. Do. |
| 9. | *Macrochlamys cinctula*, n. sp., × 2·4. | Dounggying, Burma. |
| 10. | —— *lubricata*, n. sp. Type. | Silchar, Cachar. |
| 11, 11 *a*. | —— *andersoniana*, Nevill. Type. | Ponsee, Yunan. |
| 12. | *Sakiella honesta*, Gould. | |

## EXPLANATION OF PLATE CXXII.

*Macrochlamys sufflava*, n. sp. Typical. Lhota Naga Hills.

Fig. 1 Genitalia, × 8. With spermatophore within the spermatheca. Amatorial organ shown detatched.
1 *a*. A portion of the spermatophore, part of the flume, much enlarged.
1 *b*. Ditto Ditto end of capsule, × 46.
1 *c*. Ditto Ditto spines at base of capsule, × 46.

*Macrochlamys sufflava*, n. sp. Eastern Burrail Range.

Fig. 2. Genitalia, × 19. *ep*, epiphallus.
2 *a*. Portion of the male organ, at retractor muscle attachment, with small coiled cæcum.
2 *b*. Portion seen from the other side, much enlarged.
2 *c*. Jaw, × 12.

*Macrochlamys sufflava*, n. sp. Naga Hills.

Fig. 3. Spermatophore, part of. *cap*. capsule ; *fl*. flume, much enlarged.

*Macrochlamys sufflava*, n. sp. Hengdan Peak, N. Cachar.

Fig. 4. Part of the radula, × 368.

*Macrochlamys vesica*, var. *oglei*, n. Diyung Valley, Singpho Hills.

Fig. 5. Mantle-zone showing shell-lobes detached from the animal, × 6·5.

*Cryptaustenia moyongensis*, n. sp. N. Khasi Hills.

Fig. 6. Mantle-zone detached from the animal, × 4·5.
6 *a*. Genitalia, part of, × 4·5.
6 *b*. Amatorial organ, × 8.

*am. or*, amatorial organ ; *cæ*, cæcum near retractor muscle of penis ; *gen. ap*, generative aperture ; *ov*, oviduct ; *p*, penis ; *r.m.p*, retractor muscle of penis ; *fl*, flume of spermatophore, *vide* fig. 1 *c* ; *cap*, capsule of spermatophore, *vide* fig. 1 *b*.

## EXPLANATION OF PLATE CXXIII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Euaustenia lumsdeni*, n. sp., × 2·5. | Kuram Valley, N.W. Frontier. |
| 2, 2 *a*. | *Macrochlamys herbia*, n. sp., × 4·5. | Naga Hills. |
| 3, 3 *a*. | —— *propinqua*, n. sp., × 4·5. | Do. |
| 4. | —— *ganjamensis*, n. sp., × 2·5. | Ganjam. |
| 5. | —— ——, another specimen, × 2·5. | Do. |
| 6. | —— *vertex*, n. sp., × 4·5. | Naga Hills. |
| 7. | —— *silvatica*, n. sp., × 2·5. | Dafla Hills. |
| 8. | —— *ramriensis*, Blanford, MS., × 2·5. | Ramri Island. |
| 9. | *Macrochlamys? sylhetensis*, n. sp., × 2·5. | Sylhet. |
| 10, 10 *a*. | *Cryptaustenia bensoni*, Pfr., var. × 2·5. | Rajmahal. |
| 11, 11 *a*. | —— *ovata*, H. Blf., × 2·5. | Darjiling. |
| 12. | *Durgella edeana*, n. sp., × 4·5. | Cachar. |

## EXPLANATION OF PLATE CXXIV.

| | | |
|---|---|---|
| Fig. 1. | *Euaustenia cassida*, Hutton, × 2·5. | Simla. |
| 2. | —— *cassida*, var. *stoliczkanus*, Nevill. | Naini Tal. |
| 3. | —— *scutella*, Bs., part of genitalia, × 4·5. | Chamba. |
| 3 *a*. | —— ——, male organ, × 8. | Do. |
| 3 *b*. | —— ——, do. from other side, × 8. | Do. |
| 3 *c*. | —— ——, jaw, × 12. | Do. |
| 4. | —— ——, genitalia, × 4·5. | Murree. |
| 4 *a*. | —— ——, spermatophore. | Do. |
| 4 *b*. | —— ——, (*a*) base of capsule, × 24. | Do. |
| 4 *c*. | —— ——, (*b*) base of flume, × 24. | Do. |
| 4 *d*. | —— ——, jaw, × 12. | Do. |
| 5. | *Cryptaustenia bensoni*, Pfr., animal, view of right side, × 4·5. | Rajmahal. |
| 5 *a*. | —— ——, fore part of body viewed from above, × 4·5. | Do. |
| 5 *b*. | —— ——, genitalia, × 12. | Do. |

## EXPLANATION OF PLATE CXXV.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Cryptaustenia silcharensis*, G.-A., × 2·5 | Cachar. |
| 2, 2 *a*. | —— *rarhiensis*, n. sp., × 2·5. | Sikhim. |
| 3, 3 *a*. | —— *ovum*, n. sp., × 2·5. | Cachar. |
| 4, 4 *a*. | —— *helva*, n. sp., × 2·5. | South Sylhet Hills. |
| 5, 5 *a*. | —— *nongsingriensis*, n. sp., × 2·5. | N.-West Khasi. |
| 6, 6 *a*. | *Macrochlamys beata*, G.-A., × 2·5. | Dafla Hills. |
| 6 *b*. | Animal viewed from right side, right shell-lobe, &c., × 4·5. | |
| 6 *c*. | Animal viewed from left side, left shell-lobe and foot, × 4·5. | |

## EXPLANATION OF PLATE CXXVI.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Macrochlamys scyphus*, n. sp., × 2·5. | Teria Ghat. |
| 2, 2 *a*. | —— *saltus*, n. sp., × 2·5. | Moyong, N.W. Khasi. |
| 3, 3 *a*. | —— *lahupaensis*, n. sp., × 2·5. | N.E. Munipur. |
| 4. | —— *subangulata*, n. sp., × 2·5. | Burrail Range, Naga. |
| 5. | —— *japvoensis*, n. sp., × 2·5. | Japvo Peak, Naga Hills. |
| 6, 6 *a*. | —— *sphærica*, n. sp., × 2·5. | N.W. Khasi. |
| 7. | —— *nemothaensis*, n. sp., × 2·5. | Cachar. |
| 8. | *Macrochlamys? munipurensis*, n. sp., × 2·5. | Munipur. |
| 9. | *Macrochlamys bilineata*, Godwin-Austen, × 2·5. | Dafla Hills. |
| 10. | *Macrochlamys? striata*, n. sp., × 2·5. | Cachar. |
| 11. | *Macrochlamys evidens*, n. sp., × 2·5. | Darjiling. |

## EXPLANATION OF PLATE CXXVII.

*Eurychlamys todarum*, W. & H. Blf. Travancore.

Fig. 1. Shell, × 2·4.
1 *a*. Animal, shell removed, seen from right side and above, to show the mantle-zone and shell-lobes, × 4·5.
1 *b*. Ditto, viewed from the left side, × 4·5.
1 *c*. Part of the genitalia, × 8.
1 *d*. Ditto, the same parts, seen from the other side, × 8.

Fig. 2. *Eurychlamys blanfordi*, n. sp. Baroda.

*Leptodontarion tavoyensis*, n. sp. Tavoy, Tenasserim.

Fig. 3. Animal viewed from the right side, × 4.
3 *a*. Ditto, left side, × 4.
3 *b*. Extremity of foot, sole of and mucous gland, × 8.
3 *c*. Portion of the genitalia, × 12.
3 *d*. Jaw, × 24.
3 *e*. A few teeth of the radula, very much enlarged. Five separate (on right side of plate) from near the margin, very much enlarged.

*am.or*, amatorial organ; *br*, wall of branchial sac; *cæ*, cæcum; *e*, eye tentacle, position of; *h*, heart; *gen.ap*, genital aperture; *l.s.l*, left shell-lobe; *ov*, oviduct; *r.m.p*, retractor muscle penis; *r.s.l*, right shell-lobe; *v.s*, visceral sac; *v.d*, vas deferens.

## EXPLANATION OF PLATE CXXVIII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Macrochlamys rakaensis*, G.-A., × 2·5. | Darjiling. |
| 2. | —— *chaos*, W. Blanford, × 2·5. | Burma. |
| 3. | —— *sacrata*, n. sp., × 2·5. | Parasnath. |
| 4. | —— *extraria*, n. sp., × 2·5. | Munipur. |
| 5. | —— *terminus*, Godwin-Austen, × 2·5. | East Assam. |
| 6, 6 *a*. | —— *stephus*, Bs. Young, × 8. | Andamans. |
| 7, 7 *a*, 7 *b*. | —— *superflua*, W. Blanford, × 2·5. | Sikhim. |
| 8. | —— *kumahensis*, Theobald & Stoliczka, × 4·5. | Arakan. |
| 9, 9 *a*. | —— *radia*, n. sp., × 2·5. | Murree. |
| 10. | —— *glauca*, Bs., × 2·5. | Bhim Tal. |
| 11. | —— *hyalinoidea*, n. sp., × 4·5. | Punjab. |
| 12. | —— *kulnensis*, Blf., × 2·5. | Kulu. |
| 13, 13 *a*. | —— *uda*, Godwin-Austen, × 2·5. | Burrail Range. |
| 14. | *Cryptaustenia heteroconcha*, W. Blanford, × 2·5. | North Bengal. |
| 15, 15 *a*. | *Austenia annandalei*, n. sp., nat. size. | North Bengal. |
| 16. | *Sakiella merguiensis*, n. sp., × 2·5. | Mergui. |

## EXPLANATION OF PLATE CXXIX.

*Sakiella merguiensis*, n. sp. Mergui.

Fig. 1. Extremity of foot and mantle-zone, × 4·5.
1 *a*. Mantle-zone and part near rectum showing the shell-lobes, × 4·5.
1 *b*. Genitalia (part of), enlarged.
1 *c*. Jaw, × 24.
1 *d*. Central, admedian and lateral teeth of the radula, × 368.

*Durgella edeana*, n. sp. Cachar.

Fig. 2. Jaw, × 30.
2 *a*. Some teeth of the radula, × 368.

*Sarika theodori*, Phil. Mergui.

Fig. 3. Extremity of the foot, × 2·5.
3 *a*. Genitalia, part of, × 2·5.
3 *b*. Jaw, × 30.
3 *c*. Central, admedian and lateral teeth of the radula, × 368.

*Macrochlamys sacrata*, n. sp. Parasnath.

Fig. 4. Part of the amatorial organ.

*Macrochlamys glauca*, Bs. Kumaon.

Fig. 5. Same teeth of the radula, × 368.
5 *a*. Portion of the genitalia, × 24.

*Macrochlamys lubricata*, n. sp. Cachar.

Fig. 6. Animal viewed from the right side, × 4·5.
6 *a*. Ditto, fore part from the left side, × 4·5.

*Macrochlamys kuluensis*, Blf. Kulu.

Fig. 7. Portion of a spermatophore, × 12.

*Macrochlamys sufflava*, n. sp.

Fig. 8. Teeth of the radula at different parts of the row. × 368. Naga Hills.
8 *a*. Jaw, × 30. North Cachar.

## EXPLANATION OF PLATE CXXX.

*Austenia annandalei*, n. sp. North Bengal.

Fig. 1. Animal viewed from the right side, × about 1·5.
1 *a*. Jaw, × 4 8.
1 *b*. Teeth of the radula in different parts of the row, × 295.
1 *c*. A portion of sheath of the penis, showing position of the spermatophore passing down it, × 6.
1 *d*. A spermatophore removed from the spermatheca, × 4·5.

*Austenia resplendens*, G. Nevill. North Burma.

Fig. 2. Animal viewed from the right side, natural size.
2 *a*. Ditto, the dorsal side, natural size.
2 *b*. Part of the genitalia, showing the spermatheca containing spermatophores and bent on itself in consequence, the oviduct, free oviduct, and vas deferens, × 3·5.
2 *c*. The penis, × 3·5.
2 *d*. The amatorial organ, × 3·5.
2 *e*. A spermatophore taken out of the spermatheca.
2 *f*. Coil of the visceral sac, natural size.

*Cryptaustenia heteroconcha*, H. F. Blanford. North Bengal.

Fig. 3. Animal and shell as seen from the right side, × 2·5.
3 *a*. The genitalia, × 3·5.

*Austenia rotunda*, n. sp. Cachar.

Fig. 4. Animal viewed from the right side, natural size.
4 *a*. Ditto, the left side, natural size.
4 *b*. Shell of a larger specimen, dorsal view, natural size.
4 *c*. Ditto, front view, natural size.
4 *d*. Shell removed from animal, × 2·5.
4 *e*. Ditto, underside, natural size.
Compare with figure of *A. butleri*, Pl. XC. fig. 5, also natural size.
4 *f*. The visceral sac with shell removed, showing the coil of the visceral sac, × 2.

## EXPLANATION OF PLATE CXXXI.

| | | |
|---|---|---|
| Fig. 1, 1 *a.* | *Euaustenia stoliczkana*, Nevill, × 2·5. | N.W. Himalaya. |
| 2, 2 *a.* | *Durgella? erratica*, G.-A., × 4·5. | Pegu. |
| 3. | *Macrochlamys indica*, var., × 2·5. | Cachar. |
| 4. | —— *renitens*, Morelet, large var., × 2·5. | Mauritius. |
| 5. | —— (?) *dikrangensis*, n. sp., × 2·5. | Dafla Hills. |
| 6. | —— *masoni*, n. sp., × 2·5. | Saharanpur. |
| 7. | —— *terminus*, G.-A., × 2·5. | Brahmakund. |
| 8. | —— *terminalis*, n. sp., × 2·5. | Lhota Naga Hills. |
| 9, 9 *a.* | *Pseudokaliella ornatula*, n. sp., × 2·5. | Patkai Range. |
| 9 *b.* | —— ——, portion near the keel, showing flanges on upper margin of keel. | |
| 10, 10 *a.* | *Macrochlamys uda*, G.-A., small var., × 4·5. | Lahupa Naga Hills. |
| 11. | —— *angigyrata*, n. sp., × 2·5. | Cachar. |
| 12. | *Pseudokaliella nevilli*, G.-A., hairs near keel. | Sikhim. |

## EXPLANATION OF PLATE CXXXII.

| | | |
|---|---|---|
| Fig. 1. | *Pupisoma miccyla*, Benson, × 24. | Ceylon. |
| 1 *a*, 1 *b.* | —— ——, another specimen, × 24. | Do. |
| 1 *c.* | —— ——, some teeth of the radula. | |
| 1 *d.* | —— ——, jaw, × 368. | Do. |
| 2. | —— sp., × 24. | Do. |
| 3. | —— *longstaffi*, n. sp., × 12. | Do. |
| 3 *b.* | —— ——, some teeth of the radula, × 1,100. | Do. |
| 4. | —— *cacharica*, n. sp., × 24. | Cachar. |
| 5. | *Macrochlamys striaticostata*, n. sp., × 4·5. | Cachar. |
| 6. | —— *glauca*, Bs., viewed from the right side, × 4·5. | N.W. Himalaya. |
| 7. | —— ——, viewed from the left side, × 4·5. | Bhim Tal. |
| 8. | —— *angigyrata*, n. sp., the mantle-zone, × 12. | Cachar. |
| 9, 9 *a.* | —— *indica*, var., shell and dorsal lobes seen from right and left side of animal, × 4·5. | Cachar. |
| 9 *b.* | —— ——, genitalia, × 8. | |
| 9 *c.* | —— ——, genitalia, part of another specimen, × 4·5. | |
| 9 *d.* | —— ——, the male organ of same seen from two opposite sides, × 8. | |

# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA,

INCLUDING

SOUTH ARABIA, BALUCHISTAN, AFGHANISTAN, KASHMIR, NEPAL, BURMAH, PEGU, TENASSERIM, MALAY PENINSULA, CEYLON, AND OTHER ISLANDS OF THE INDIAN OCEAN.

SUPPLEMENTARY TO MESSRS. THEOBALD AND HANLEY'S

CONCHOLOGIA INDICA.

BY

LIEUT.-COLONEL H. H. GODWIN-AUSTEN,

F.R.S., F.R.G.S., F.Z.S., &c.,

LATE DEPUTY SUPERINTENDENT TOPOGRAPHICAL SURVEY OF INDIA, IN CHARGE OF THE KHASI, GARO, AND NAGA-HILLS SURVEY PARTY.

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In Memory of

JESSIE GODWIN-AUSTEN.

This work is dedicated to a devoted wife and helpmate, who for many years by her deep interest, encouragement and help, promoted my work.

H. H. G.-A.

Nore. 21st July, 1913.

# LAND AND FRESHWATER MOLLUSCA

OF

# INDIA.

## VOL. II.

**Part XII.—DECEMBER 1914.**

(Plates CXXXIII.—CLVIII.)

## INTRODUCTION.

The first notice we have of representatives of slugs belonging to a Palæarctic Family occurring in the Himalayas, is a note of Ferdinand Stoliczka's quoted by G. Nevill in 'Scientific Results of the Second Yarkand Mission' (1878), p. 21, under 26, *Anadenus* sp.: "I also found near here (Changligali near Murree) specimens of an Arion and specimens of two other Arion-like slugs." On this Mission Dr. Stoliczka collected Mollusca over a great extent of country, one place being Sonamurg at the head of the Sind Valley, Kashmir. Here he obtained *austenianus*, Nev., a species of *Parvatella* with *kashmirensis*, Nev. and *sonamurgensis*, Nev., of which the true generic position is unknown; they were placed in *Nanina* (*Rotula*) by Nevill. This was some 35 years ago, since when, out of the many hundreds of English travellers who have passed this way, not one happened to be a conchologist.

Last summer (1910), on hearing Mrs. Pocklington and her daughter were in Kashmir and going to spend several weeks at the head of the Sind Valley, I enlisted the latter's services in a search for land shells and particularly slugs—remembering what Stoliczka had obtained when rapidly passing through Sonamurg with the Forsyth Mission to Yarkand, from which country my

friend never returned * ; his loss to science was irreparable, for there was no one in India then capable of working out much of the material he collected, certainly in the Mollusca. I had long felt that in this part of the Kashmir Himalaya and away west to Chitral and Swat many interesting species were to be collected, and I may add in all the higher valleys from Kashmir eastwards to Nepal.

Miss Pocklington responded to my call most splendidly, overcame the blanks of the early days' searchings, discovered where to look, and finally sent me the results which I am now partly able to describe, and I thank her for the great aid she has afforded to the history of the Indian Land Mollusca and their distribution. Among the species preserved in spirit I find representatives of the genera *Limax*, *Anadenus*, *Enaustenia*, *Buliminus*, &c. ; while, curious to say, there is not a single example of the species Ferd. Stoliczka collected in 1874. This is to be accounted for, Stoliczka never got far from the Zogila route, while Miss Pocklington was in camp near the large glaciers much farther up the Valley.

## Family LIMACIDÆ, Gray.

Representatives of this family have not hitherto been described from the Himalayan Range, and it is not surprising that the first should be found on the extreme North-west of the chain, on the borderland of the Palæarctic fauna and flora. It is an extremely interesting fact in distribution, which all Malacologists will be interested in.

When describing this species of *Limax*, I cannot refrain from saying how valuable I have found the detailed information in Mr. John W. Taylor's Monograph of the Land and Freshwater Mollusca of the British Isles, on the generic divisions of the family.

### Subgenus Kasperia, nov.

Several characters differ much from those found in the subgenera of *Limax* inhabiting the European area and extending into Asia, such as *Agriolimax* and *Milax*. The form of the shell, the strongly keeled foot, the very short and thickened vas deferens, the very large black pigmented ovotestes, the form of the teeth of the radula, these together I consider are sufficient to give this Eastern form subgeneric rank.

Limax (Kasperia) mayæ, n. sp. (Plate CXL. figs. 1–12.)

*Locality*. Tejwas or Tajwaz, Sonamurg, Kashmir. (Miss M.

* *Vide* notice of his death (Proc. A. S. Bengal, 1874, p. 152).

Pocklington, 1910.) One large and four very young specimens. "The small slugs were found on old tree-trunks and damp ground in the fir woods."

Shell (fig. 5) white, margins thin transparent, central portion thickened, elongately quadrate, symmetrical; the protoconch is granular internally, in young specimens this is probably the early state of the shell, the surface is marked by layers of concentric growth.

Length 6·0, width 3·5 mm.

*Animal* (fig. 1). Largest, length 30 mm.: smaller specimens, (1) 19; (2) 18; (3) 17·5; (4) 16·5 mm. Ochraceous, grey on extremity of the foot. The mantle (fig. 4) dark grey, the darkest part of the animal, its surface rough, broken up by irregular fine papillation and short grooves, paler round the respiratory orifice (fig. 3) forming a sort of disc (fig. 3), (*vide* Mon. Moll. Brit. Is. p. 79, fig. 96, which is somewhat similar to *Limax flavus*: however, the shell of this is quite different from this Kashmir species). Foot very pointed, dorsum sharply keeled, very distinctly divided on the sole, an inner and outer line of parallel quadrate tubercles on each side of the central area. The grooving on the side of the foot rather close and regular and broken up into elongate quadrate tubercles; on the peripodial margin there is a single groove, constituted by a double row of minute tubercles.

The visceral sac extends to the extremity of the foot.

*Generative organs* (figs. 8 & 9). The ovotestis is a large spreading black mass, and is conspicuous on the surface of the visceral sac, when the animal is removed from within its integumental covering. The hermaphrodite duct is long, fine, closely twisted at one part and then becoming thicker joins a very large albumen gland of a pale lemon-yellow colour. The prostate is remarkably well developed and continues close up to the male organ; it is connected with it by a very thick short vas deferens, which unites with the penis on the side just below the top of the sheath. The ovotestis is continuous with it close up to the vas deferens, the free oviduct being very short. The penis is a short, thick cylinder, with a short strong flat retractor-muscle on the side. A longitudinal section (fig. 11) through this showed a single bulbous pillar, and some short plications above. This is more after the same part of *L. flavus*, l. c. fig. 98, p. 79. The spermatheca is a globose sac on a very short stalk, joining the free oviduct close to the generative aperture. No accessory glands seen.

The jaw is oxygnathous with a central projection darkish in colour—it was unfortunately lost.

In the radula (fig. 6, 6 *a*) the central tooth has straight sides, with just a sign of a notch below the apex; the admedians are on broader plates and have a cusp on both the inner and outer sides, up to the 11th tooth, in which these cusps are very reduced in size and are not seen in the 13th and 14th. About the 21st they are unevenly bicuspid, the outer cusp well below the point; the marginal

teeth become small, still bicuspid, but more evenly so. The formula is

36 . 1 . 11 . 1 . 11 . 1 . 36
or 48 . 1 . 48.

The spermatophore (fig. 12) is a simple sac on a short flume, no spines.

PARMACELLA, Cuvier, 1805.

Subgenus KANDAHARIA, Godwin-Austen, 1888.

In Part VI., Moll. Ind. 1888, pp. 216–17, reference was made under *Girasia* to a species from Afghanistan, found and named by Capt. Thos. Hutton *rutellum*, which Mr. Gray had put in this genus with a query. Hutton's description is given on p. 217. I then made reference to a species the late Mr. M. Ogle had sent me from the Afghan side of the Kojhak Range, for which, as it certainly was not a *Girasia*, I proposed the generic name of *Candaharia*.

When sending me the animals preserved in spirit Mr. Ogle wrote:—"These specimens were found in the month of April in the bed of a dry pebbly nullah at an elevation of 6000 feet. This nullah takes its rise in the Kojhak range of hills on the border of Afghanistan and Baluchistan, and is on the Afghan side. It is curious that they were obtained in that one particular spot only, though they were diligently searched for elsewhere."

PARMACELLA (KANDAHARIA) KOJHAKENSIS, n. sp. (Plate CXLII. figs. 1–8.)

West side Kojhak Pass, Afghanistan (*M. Ogle*).

*Animal* (fig. 1). The foot short behind, pointed, sharply keeled, with coarse papillation between grooves running from the peripodial margin towards the mantle. This is smooth, with the respiratory orifice on the right central side. Shell on the posterior end and sunk in a depression of the body (fig. 3). Foot below has a central ambulatory area, bordered with 7–8 parallel grooves. Two parallel furrows run from between the eye-tentacles backwards along the middle of the neck. In life the apex of the shell is concealed by the mantle and is buried in the deep hollow at the posterior end (fig. 4). The generative orifice is behind the oral tentacle showing as a short perpendicular slit. The body-cavity extends to the extremity of the foot.

*Size.* Total length in spirit 40 mm.; mantle 17: extremity of foot to mantle along the keel 7. A small specimen 27 mm. long.

*Shell* (fig. 5). There are remarkable differences in the structure of the smooth single-whorled solid apex, and the thin flat form of the anterior part, which is narrow and spatulate. The protoconch stage of the animal would be an interesting study, vide *Vitrina buccata*, Hutton, further on.

The length is 9·0, the width 4·0 mm.

This shell differs from *Parmacella deshaysei* in the protoconch

being larger in proportion to the anterior part, this last in *deshaysei* being also much broader and spread out.

*Generative organs* (fig. 6). The retractor penis is given off from the end of a shortish sheath, from the side of which there is a thick very elongate tube on the rounded termination of which the vas deferens unites, and this is very long. The spermatheca is a globose sac at the end of a short stalk. Near the base of the generative aperture there is a long accessory organ or gland. The ovotestis is large.

The radula (fig. 8) has the formula of 21 . 24 . 1 . 24 . 21, or according as the transition teeth are counted:

16 . 29 . 1 . 29 . 16

or 45 . 1 . 45.

The central tooth is tricuspid, the admedians broad and even in size also tricuspid, the marginals short and stout, with no side cusps. The jaw (fig. 7) is smooth, oxygnathous, dark coloured, with a slight central projection.

I have purposely kept back any further description of this interesting species, until I had seen the animal of true *Parmacella* from North Africa, with which I could compare it.

An exhaustive excellent description of the anatomy of *Parmacella olivieri*, Cuv., from the Caspian, is given by Dr. Heinrich Simroth in Jahrbucher d. Deutschen Malakozool. Gesells. 1883, with beautiful figures of the different parts of the animal. This has proved most valuable, for I was able to obtain last summer (1912) through M. P. Pallary of Eckmuhl, Oran, specimens of *Parmacella deshayesi* which reached me alive, but with all the care I bestowed upon them they did not survive long. A comparison of their anatomy with Simroth's figures and those of the Afghanistan species is very interesting. In the first place, the principal difference between *P. olivieri* and *deshayesi* consists in the greater distance the spermatheca of the latter is situated from the genital aperture. Secondly, in the presence of what Simroth terms the clitoris (Pl. CXLII. fig. 9 *a*, *cl.* 1 and *cl.* 2), corresponding to the dart-sac of the *Helices*. There is difference in the details, they have not the same outward form, but their position is similar close to the generative aperture. I opened out both of these to see the interior as shown in fig. 7 of Simroth's Plate. In the first (*cl.* 1), near the apex, there is a sharp fold of the wall forming a long narrow pale coloured ridge fining out gradually forwards. This is soft and muscular apparently, if hard it would be a perfect dart: may it not be its analogue? In the other (*cl.* 2) the inner walls are smooth and creased, and there is one, elongate rod-shaped, fairly thick at the base, tapering to a fine point at the free end, and attached for its whole length to the wall of the sac. By the side of this is another branched and isolated similar ridge or folding. Having seen these accessory organs in the North African species, still more interesting became the anatomy of the one from Afghanistan, and

I examined another specimen to see that I had not missed anything. I was glad to find fig. 6, made some years ago, was correct. The complicated accessory organs of the African form, and also of that described from the Caspian by Simroth, are represented in the Afghan species by only one very elongate rod, as I may term it, for it is not a hollow sac, but of hard, close, granular texture, within nothing like a dart to be seen, and apparently a secretory organ only.

The anatomical differences the Afghan species exhibit are, I consider, quite worthy of subgeneric separation, and I therefore retain the original name *Candaharia*, which I gave it prematurely and before I knew enough of its relationship. I do not consider this species from the Kojhak Pass as likely to be the same as *Parmacella rutellum* of Hutton, only 12 mm. in length. Its colour, noted by Hutton, is very distinctive "bright gamboge-yellow," and I think my old assistant Ogle would have mentioned the character in his letter, above quoted, had they been so conspicuously coloured. Khojak specimens in spirit are grey, in life possibly green. Species of this genus may very possibly occur at Quetta and adjacent valleys; I hope I may be able to interest someone quartered there to look for them. This I have done during the past year, 1913.

Colonel F. Webb-Ware, C.I.E., political agent at Chagai, has very kindly made enquiry, and, through him, the political agent at Thol, but with negative results. He has heard (April 1914) of large yellow slugs 60 miles from Nushki. Enquiry made of the Baluchistan Natural History Society was equally barren. More successful in search of land-shells has been my brother-in-law, Captain D. G. Robinson, who was at the Staff College, Quetta. On Zerghun Peak at 9500 ft. he has sent me three species—a most interesting small Zonitoid (perhaps a new genus) and two species of *Pupa*. This instalment is very promising. Baluchistan is a country of sand, barren rocks, and arid plains, quite unworked, but I feel sure numerous species are to be found there.

Captain Hutton, in the same paper in which he describes *Parmacella rutellum* from Kandahar, described *Vitrina baccata*. I have a copy of this paper given me in 1862 by him, on which he wrote "proves to be the young of *P. rutellum*." As the early stage of this mollusc is of considerable interest, I quote Hutton's description:—

"2. Vitrina baccata.

"This very minute species was found under stones along the bank of a dry nullah or river-bed, at a place called Melmandeh, between the Kojuck Pass and Kandahar. It appeared to be very scarce, as after a lengthened search only three specimens were found, and of these unfortunately the animals died before an opportunity occurred for examining them. Shell small, thin, fragile, diaphanous and pale; whorls apparently only one, or at all events the body-whorl may be said to constitute the whole shell; aperture nearly circular, lips scarcely interrupted, slightly thickened

and partially reflected; surface of the shell polished, finely striated by minute lines of growth, and ornamented with longitudinal bead-like lines or strings of minute bubbles, which can be seen only under a strong lens. Upperside depressed, flattened; underside rounded, ventricose. Length $1\frac{1}{2}$ lines."

## Hyalinia, Fér., 1819.

### Sect. Zonitoides, Lehmann, 1864.

In a paper on new species from Ceylon in the 'Proceedings of the Malacological Society of London,' July 1897, vol. ii. p. 235, Mr. E. R. Sykes described *Polita notabilis* with figures of the shell. Pl. xvi. figs. 21–23.

In March 1912, when looking through spirit-specimens in my collection, I came across a tube of this species collected at Ambagamua, Ceylon. Being so interesting a form from this locality, I examined the animal; fortunately there were a good number of specimens, for as they were in a brittle state, some six had to be dissected before I could decide satisfactorily its generic position. Mr. Sykes writes, after describing *P. notabilis*, as follows:—

"It is almost hopeless to devise a description of a species of this form which will prove sufficient for its recognition, and the assistance of the artist must be called in, if there is to be any hope of its identification by future workers. The genus *Polita*, although one would hardly expect to find it in Ceylon, appears conchologically quite suitable, and until we are acquainted with its anatomy, the species may be placed there with *P. nitida*, &c." As will be seen, this was a remarkably close identification on Mr. Sykes's part.

Zonitoides notabilis, Sykes. (Plate CLII. figs. 2–2 *g*.)

The animal (figs. 2, 2 *a*) is dark coloured, foot not divided, pointed; not in a state to see the mucous gland if it be present; a peripodial margin with two grooves above; right dorsal lobe small, left in two nearly equal parts and narrow.

The radula was typical of *Hyalinia*, having the formula

26 . 6 . 1 . 6 . 26.

Three specimens examined. The jaw (fig. 2 *c*) rather straignt in front with a large central projection, rather angulate above. The extreme marginal teeth are very minute and aculeate.

In the generative organs (figs. 2 *d*–2 *g*) the most conspicuous adjunct is the dart-sac; it is elongate, solid, bluntly headed, curved more or less at the distal end, with a small pear-shaped coronal gland, and having a long retractor muscle. Within the rounded head is a pear-shaped or elongate more solid mass from the stalk end of which is a thin, long, beautifully shaped, finely pointed dart, the base of which is funnel-shaped (fig. 2 *f*). The penis is seen through the transparent wall of the visceral sac lying beside

the dart-sac, a simple sheath with the vas deferens given off at the extreme end; no doubt there is a retractor muscle here, but it was not seen in the specimens I examined. In strong transmitted light it was noticed that the anterior end of the penis terminated in a transparent point, of a different nature from the portion to which it was attached (fig. 2 *d*). The spermatheca was not seen complete either, and I could see no sign of the bifid duct at the base. In one specimen it was very long (fig. 2 *e*), slightly swollen and pointed at the end, and probably unites with the bulbous mass near the generative aperture (*sp.*).

My task of locating this species in its generic position in the Hyalinia group of the Mollusca has been rendered comparatively easy by the labour of Mr. John W. Taylor in his excellent 'Monograph of the Land and Freshwater Mollusca of the British Isles,' *Zonitoides*, p. 133, and the photographic work of the late Mr. W. Moss. Following Mr. Taylor's classification, *Polita notabilis*, in its anatomy is similar to that of *Zonitoides excavatus*, Bean, and *Z. nitidus*, Müller, particularly in the generative organs, which are of a type quite unlike those of the more simple type seen in *H. alliaria*, Müll., *nitidula*, Drap., &c.; the last-named species Mr. Taylor places in the subgenus *Polita*, Held., created by that naturalist in 1837. The form of the dart is absolutely the same as that of *Z. excavatus*. I have noted a transparent termination of the male organ (fig. 2 *d. p.*), and referring to figs. 184 & 185 of p. 135 of the above Monograph, I am inclined to think it represents the calcareous so-called penial plate there represented.

The radula presents teeth of the same form as those shown on p. 136, but the formula differs, thus:

| | | | |
|---|---|---|---|
| In *excavatus* it is | 16 . 9 . 1 . 9 . 16 | or | 25 . 1 . 25; |
| *nitidus* | 20 . 5 . 1 . 5 . 20 | or | 25 . 1 . 25; |
| *notabilis* | 26 . 6 . 1 . 6 . 26 | or | 32 . 1 . 32. |

One example of the radula of the last was mounted without the loss of a single tooth in most of the rows.

Conchologically *notabilis* is very distinct from *excavatus* and *nitidus*; making an allowance for loss of colour in alcohol, there is no sign of the brown so typical of most of the species of *Hyalinia*; in the grey or colourless species such as *pura* and *crystallina*, the generative organs are not like those of *Zonitoides*.

Great interest surrounds *Z. notabilis* as to whether it is an indigenous species in Ceylon or introduced. If introduced, from what part of the Northern Hemisphere did this Palæarctic genus come? There is hardly any other part of this tropical region to which species of the land mollusca might more easily be carried than Ceylon, when one considers the thousands of acres which have been brought under cultivation by European capital, and that this was commenced so many years ago, long before tea cultivation in India was started, which I can well remember was about 1855. Managers and their assistants would be receiving

plants of all kinds from fruit trees to flowers, and thus this particular species may have come from some far northern area, yet to be discovered.

The genus *Zonitoides*, represented by *nitidus*, has an enormous range (*l. c.* fig. 198, Geographical Distribution), south to the Mediterranean, eastward to the Caucasus and Siberia, Northern India, Kashmir, north of the Pir Panjal (*Theobald*), Little Thibet, and Ladak. So that the species from Ceylon, with its anatomy the same as in *Z. excavatus*, may have any part of the above area as its home.

In the Calcutta Museum Nevill records a specimen of *nitidus*, sent to him by Dr. J. C. Cox from New South Wales, and no doubt the same species has been introduced into many other parts of the world.

In Ceylon *Z. notabilis* would appear to be local, for I can only trace it to Watawala (*Collett*) typical, and those I have lately examined from Ambagamua (*Collett?*). Whether it is more generally distributed in the island is of considerable importance. If this should be the case, and we could without doubt assume it to be an indigenous genus, it would be a most remarkable example of Geographical Distribution, one hardly possible to explain in relation with the predominant fauna and flora, and on geological evidence of past land extension.

## ZONITIDÆ.

### Genus PARVATELLA, W. T. Blanford.

Blanford, Faun. Brit. Ind., Mollusca, p. 145 (1908). Type, *flemingi*, Pfr.

*Range.* Western Himalayas of Kashmir.

(Continued from Moll. Ind. Vol. I. p. 216.)

PARVATELLA AUSTENIANA, G. Nevill. (Plate CL. figs. 1–1 *g*.)

Moll. Ind. vol. i. p. 215 (included in *Macrochlamys*). See synonymy and original description: Blanf. & G.-A., Faun. Brit. Ind., Moll. p. 148 (1908).

Having recently received from the Indian Museum, Calcutta, through the kindness of Dr. N. Annandale, the spirit-specimens (Nos. 5479–82) collected by Ferdinand Stoliczka when passing through Sonamurg attached to the Second Yarkand Mission, I am able after so many years to give a few notes on the anatomy of this species, described by Nevill in the 'Scientific Results.' The spirit unfortunately evaporated, but after long soaking it left one large specimen, the shell of which is 19·25 mm. in major diameter, in a good state for examination. The anatomy agrees with that of *Parvatella flemingi* in every way. The large amatorial organ (fig. 1 *d*) in the penis, the disc-like coil to the side of which the retractor muscle is attached, is conspicuous (fig. 1 *c*). The spermatheca is short. The left shell-lobe small, narrow, and pointed (fig. 1 *b*). There were also with the above large specimens two

much smaller, which I at first concluded were of another species, possibly *sonamurgensis*. Fortunately portions of the shell still remained attached to the body, and in one the protoconch. This, together with the external characters, left no doubt they were very young specimens of *P. austeniana*. Of these I give figures (figs. 1, 1 *a*) which may be compared with that of *P. flemingi* (Faun. Brit. Ind. fig. 53, p. 146). The right shell-lobe is long and tongue-like, the left small and triangular; the sole of the foot is very distinctly divided. The fringed peripodial margin is broad, much paler than the portion of the foot above it; one peripodial groove distinct, the other not so, but it can be made out.

The generative organs of the smaller specimen were not seen entire and united. The amatorial organ was rather short and thickened, with blunt, pear-shaped point. The spermatheca was elongately pear-shaped, and this contained a very perfect spermatophore (fig. 1 *g*), quite typical of the subfamily, yet differing somewhat in minor detail and worthy of description. The capsule is elongate, at its anterior end it has only a few spines—a set of three on one side of the flume, a bunch of four bifurcate spines on the other. The flume was continuous down the duct or stem of the spermatheca to where it was broken away from the free oviduct.

The jaw was lost. The radula is not in a state to count the number of teeth in a satisfactory way, having got folded on itself, but there is enough to show that in number and form they are very much as in the larger specimen.

The opportunity of examining a very interesting land-shell has been afforded me by the kindness of Baron Rösen, to whom my sincere thanks are due for sending me some excellently preserved specimens from Samarkand of *Macrochlamys sogdiana*. For many years I have been most desirous of seeing the animal of this species assigned to *Macrochlamys* having this far Western habitat. Nevill alludes to this in the 'Scientific Results of the Second Yarkand Mission (Mollusca)' as follows:—"The most interesting fact, however, seems to me to be the entire disappearance, on leaving Sonamurg on the confines of Kashmir, of the characteristic Indo-Malayan genus *Nanina*, which reappears again (with two species of the subgenus (*Macrochlamys*) in the Sarafshan Valley); the same is also the case with species of *Buliminus* (*Napæus*), *Parmacella*, and *Limax* (?). The two last, however, belong to the European fauna, and species of them are mere stragglers on the extreme north-west confines of India."

The first species of the *Macrochlamyinæ* from this part of Central Asia was described by Von Martens *.

* Malak. Blätt. 1871, vol. xviii. p. 65, pl. i. figs. 1–3—*Helicarion sogdiana*. This genus I have shown is an Australian one, with an animal very distinct from the Asiatic *Austenia*, &c. It is the genus *Macrochlamys*, included in the Caucasian Province by the Rev. A. H. Cooke, "Mollusca," Cambridge Nat. Hist. p. 296 (1895).

PARVATELLA SOGDIANA, Von Martens. (Plate CXXXV. figs. 1–1 *f*.)

The animal (figs. 1, 1 *a*) is about 22 mm. long in the spirit-specimen dissected. It has ample shell-lobes, pale in colour and quite smooth; the right shell-lobe is given off from the border of the right dorsal lobe, and spreads upon the right lower side of the body-whorl in life. It is broad and somewhat elongate. The left shell-lobe is a narrow tongue-like expansion, gradually growing out of a narrow band which overlaps the edge of the peristome. The right dorsal lobe is large; the left dorsal is in two distinct parts, the anterior large, the posterior quite narrow and slightly overlapped by the anterior lobe. The peripodial grooves very distinct, with distant well-marked grooves leading from the upper one towards the keel of the foot. Foot very distinctly divided. The mantle-margin has a narrow pale band. The visceral sac beyond and walls of the branchial cavity are black, the kidney showing pale coloured against it.

In the genitalia (fig. 1 *c*) the amatorial organ is very large, evenly cylindrical for the whole of its length, and rounded at the distal end. The male organ (fig. 1 *d*) has a cæcum, closely wound into a ball-like shape, to which the retractor muscle is attached. The epiphallus is short, and there is a short kalc-sac; the vas deferens is also short. As regards the genitalia, a comparison with fig. 53, 'Fauna of British India, Mollusca,' p. 146, shows great similarity with *Parvatella flemingi*, and externally in the shell-lobes, only that in this Samarkand species they are broader and larger.

The jaw (fig. 1 *e*) is very convex, narrow, and thick, with a central projection.

The radula (fig. 1 *f*) formula is

$$30 \;.\; 3 \;.\; 18 \;.\; 1 \;.\; 18 \;.\; 3 \;.\; 30$$

or

$$51 \;.\; 1 \;.\; 51.$$

The central and four first admedian teeth are tricuspid, the inner upper cusp being a sort of shoulder below the apex. The lateral teeth have the outer basal cusp very small, with a long aculeate point. The outermost marginals are minute and bicuspid.

The range of this genus of the *Macrochlamyinæ* so far to the north-westward is of considerable interest in distribution, and at first is somewhat difficult to account for. But as it is a Kashmir Himalayan form, occurring in a high forest-clad valley such as the Sind at Sonamurg, species will no doubt be found in Astore, Swat, Chitral, Wakhan, and Darwaz, up to the Zarafshan Valley, following the high valleys of the main watershed of the Himalayan elevation in the north-west direction. Although we have occupied Chitral now so many years, no conchologist would appear to have visited the country. I am certain that in the more wooded portions many interesting land-shells must exist.

### Subfamily Macrochlamyinæ.

### Genus Macrochlamys.

(*Continued from* Vol. II. Part XI. p. 272, 1910.)

In the Kashmir Himalaya certain variation is apparent in species of the subfamily *Macrochlamyinæ*. Nevill noticed this in 1878, when he placed *chloroplax*, Bs., and *kashmirensis*, Nev., in *Rotula* as a subgenus of *Nanina*. Blanford later, when preparing for the publication of the first molluscan volume of the 'Fauna of British India,' suggested *Parvatella* for *flemingi*, inhabiting the Murri Hills, which Pfeiffer originally placed in *Vitrina*. I have since found that *Parvatella* extends to Samarkand. *M. kashmirensis* and *sonamurgensis* are sufficiently distinct to be placed in a new subgenus I now describe. Other species of it will in all probability occur away to the westward in the highlands of Buner, Swat, and the Panjkora River, when those hills shall be collected in for land mollusca. Nothing is known at present from that large extent of country.

### Subgenus Rhadella, nov.

Type, *R. kashmirensis*, G. Nevill.

Shell small, perforate, considerably depressed or lenticular, more or less carinate. Sculpture plicately striate above, less so below, smooth near the umbilicus or closely ribbed above, and beneath much smoother.

Animal with small right and left shell-lobes. Generative organs like those of *Macrochlamys*; coiled cæcum of penis large.

Radula with few teeth in row, about 60.

Macrochlamys (Rhadella) kashmirensis, Nevill. (Plate CL. figs. 2, 2 *a*, 2 *b*.)

*Nanina* (*Rotula*) *kashmirensis*, Nevill.

*Nanina kashmirensis*, Nevill, Hand-list, i. Dec. 1878, p. 33.

30 Sonamurg, Kashmir (type); coll. Dr. F. Stoliczka.

Two specimens in spirit (Nos. 5483–84) received from Dr. Annandale, September 1911.

Blanford & Godw.-Aust., Faun. B. India (Mollusca), 1908, p. 165.

*Khasiella* ? *kashmirensis*, Nevill.

Nevill described this species in the 'Scientific Results of the Second Yarkand Mission (Mollusca),' 1878, p. 16 (Plate, figs. 13–15), placing it in the above subgenus.

*Original description*:—"Shell small, closely resembling the preceding *Nanina* (*Rotula*) *chloroplax*, from which it can, however, be easily distinguished by its smaller size, less depressed shape, much more closely-wound whorls, higher spire, and less acute keel; by the more convex base, which does not possess the excavated depression round the umbilicus so characteristic of its ally; the umbilicus

itself also is smaller. The sculpture is apparently the same : above subplicately striate, below the same, but less developed than above. I think both should rather be described as most minutely punctuate rather than 'tenuissime decussata' as in the original description of *N. chloroplax*. The aperture is quite different, being much less dilated in the present species, with scarcely any trace of the acute angulation in the middle of the outer margin, and with the columella less oblique and more rounded at the base.

"Full-grown type of *N. kashmirensis*: diam. $7\frac{1}{2}$, axis $3\frac{3}{4}$, alt. $4\frac{1}{2}$, apert. lat. $3\frac{1}{2}$, alt. 3 mm.

"Young specimens of *N. chloroplax* (for comparison): diam. $7\frac{1}{2}$, axis $3\frac{1}{2}$, alt. $4\frac{1}{4}$, apert. lat. 4, alt. 3 mm.

"Abundant at Sonamurg. Collected by Ferdinand Stoliczka."

In this description all its characters are compared with a species found near Murree, which Nevill had determined as *H. chloroplax* of Benson, the typical locality of which is Simla. Thus further comparison is needed of the two forms.

*Animal.* Has a few distant brown specklings on the wall of the branchial sac. Right and left shell-lobes small but distinct, and a well-developed lobe or horn over the mucous gland at the extremity of the foot (fig. 2 *a*).

In the genitalia (fig. 2) the penis is of the type found in the subfamily Macrochlamyinæ, with a coiled cæcum forming a rounded mass from which the retractor muscle is given off. This is short, the place of attachment is on the visceral sac. The kale-sac is large and pointedly oblong, not flagellate. The amatorial organ is rather short and thickened.

The jaw (fig. 2 *b*) has a central projection and is moderately curved.

The radula formula is

18 . 1 . 9 . 1 . 9 . 1 . 18

complete, or 28 . 1 . 28.

The centre and admedian teeth on square plates of the usual form; marginals small, few in number, unevenly bicuspid, very minute on the outer margin.

The following species may also be placed in this subgenus:—

MACROCHLAMYS (MICROCYSTIS ?) SONAMURGENSIS, G. Nevill.

G. Nevill, Sci. Results 2nd Yarkand Mission (Mollusca), 1878, p. 16, Plate, figs. 16–18; id., Hand-list (*Nanina sonamurgensis*, Nev.), p. 33, no. 117; Blanford & Godw.-Aust., Faun. B. India, Moll. p. 166 (1908).

*Khasiella ? sonamurgensis*, Nevill.

*Original description.* "Shell small, depressed, thin, horny brown, with the suture distinct; roughly, regularly, and closely ribbed above; sculpture of a similar kind, but almost obsolete, can be

traced on the base; whorls seven, closely wound; the last scarcely, if at all broader than the previous one, more or less subangulate at the periphery; base convex, distinctly excavated round a deep, narrow umbilicus; aperture very shallow, the outer margin distinctly thickened, slightly subangulate in the middle; columella very slightly reflected, oblique, evenly rounded, without any angulation at the base, in this character resembling *N. splendens* and differing from *N. prona*.

"I know of no Indian species like this interesting little shell; in shape it somewhat resembles the smooth *N. woodiana*. Diam. $11\frac{1}{2}$, alt. $5\frac{1}{2}$, axis $4\frac{1}{2}$, apert. lat. $5\frac{1}{2}$ mm.

"Dr. Stoliczka found a few specimens alive at Sonamurg; he notes that the animal is provided with a mucous pore."

The resemblance to *N. woodiana*, mentioned above by Nevill, is a conchological one. The animal of *woodiana* I have never been able to obtain; it is from Southern India. What its generic position is has yet to be determined.

Nearly 40 years have gone by since these two species were discovered by Stoliczka. From him I received much help and encouragement; he was one of those officers of the Geological Survey of India with whom I came in contact, just at the time the Indian land-mollusca had attracted my attention. It has therefore been a labour of love to examine these animals and establish their generic position, feeling as if Stoliczka was by my side while carrying on the work he began. I am more than usually indebted to Dr. N. Annandale for entrusting me with these valuable spirit-specimens, which have lain so many years in the Calcutta Museum.

MACROCHLAMYS DECURSUS, n. sp. (Plate CL. fig. 3.)

*Locality*. Sheroifurar Peak, Lahupa-Naga Hills, N.E. Munipur, No. 581 B.M. Coll. (*Godwin-Austen*).

The shell was unfortunately lost before the description was made, but that of the animal is sufficient to enable any malacologist who may visit that fine peak in Munipur to determine the species.

Animal black throughout: a long, broad, tongue-shaped right shell-lobe; left shell-lobe small; foot divided.

A very long amatorial organ and long spermatheca.

Radula as usual; laterals bicuspid. This is mounted on a slide in the B.M. Collection.

MACROCHLAMYS? SILCURIENSIS, n. sp. (Plate CLVIII. fig. 9.)

*Locality*. Silcuri, Cachar. 4 specimens from the Indian Museum, Calcutta: type returned (*J. Wood-Mason*).

Shell perforation hidden, globosely conoid; sculpture, rather coarse irregular transverse striation, not a sign of any longitudinal; colour pale burnt sienna; spire high conic, apex blunt, sides convex; suture shallow; whorls 6, regularly increasing, sides

flatly convex, the last subangulate on the periphery, disappearing near the aperture; aperture rather widely lunate, subvertical; peristome thin, slightly reflected on the columellar margin and reflected (the type-specimen shows distinct varix of an old aperture).

Size: maj. diam. 5·5; alt. axis 3·3 mm.

This species had been placed in *Kaliella* with considerable doubt. In form it approaches *M. neugloensis*, G.-A., from the Naga Hills (Moll. Ind. plate xvii. fig. 3), which again is near *M. longicauda*, G.-A. (plate xvii. figs. 1, 2–2 *a*, & 4, shells). When more is known of this small group it might constitute a new sub-genus.

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## Genus Pseudokaliella.

(*Continued from* Vol. II. p. 297.)

Pseudokaliella dihingensis, n. sp. (Plate CLVIII. fig. 2.)

*Locality*. Dihing Valley, Eastern Assam. No. 614 B.M. (*M. Ogle*).

Shell turbinate, somewhat depressedly, sharply keeled; sculpture fine, even costulation on all the whorls, continuing over the keel to the basal side, radiating from the umbilicus, at the keel the edge is roughened; colour dark sienna-brown; spire half as high as the diameter, apex blunt; suture impressed, a lirate edge follows it from the aperture, with another finer thread above it; whorls 6, regularly increasing; aperture semilunate, rather narrow, oblique; peristome thin; columellar margin oblique.

Size: maj. diam. 7·5; alt. axis 3·5 mm.

A very distinctive species—only one specimen was found.

Pseudokaliella akhaensis, n. sp. (Plate CLVIII. fig. 3.)

*Locality*. Barowli Gorge, Durrang District, Assam. No. 615 B.M. (*Godwin-Austen*).

Shell scarcely perforate, very depressedly turbinate, sharply keeled; sculpture regular, close, rather coarse transverse ribbing, crossed by 1 distant longitudinal liration, next the suture and keel, and 1 or 2 finer above; colour dark ochreous; spire low, sides flat, apex blunt; suture moderately impressed; whorls 5, closely and regularly wound; aperture semilunate, suboblique; peristome thin, angulate at the periphery; columellar margin oblique.

Size: maj. diam. 7·0; alt. axis 1·25 mm.

Only one specimen was found—in this case the form is so distinctive, that it would be readily recognized when it comes to be taken again.

## Genus Kaliella.

(*Continued from* Vol. I. p. 73, 1883.)

Kaliella henzadaensis, n. sp. (Plate CLVIII. fig. 11.)

*Locality.* Kyoung Gyoung, Henzada, Pegu. Blf. Coll. No. 1017, 06.1.1 B.M.

Shell pyramidal, finely perforate; sculpture regular, transverse striation, the same concentric on the basal side; colour ochraceous; spire high, sides flatly convex; suture shallow; whorls 6, sides slightly convex; aperture broadly lunate; peristome rather solid, subvertical on the columellar margin.

Size: maj. diam. 2·3; alt. axis 2·9 mm.

This shell might pass for *K. barrackpurensis*, and the sculpture is somewhat similar, not quite so. It is higher in the spire than the typical species, and not so broad at the base. The aperture is very large for its size, and the columella is strong and nearly vertical.

The single specimen was found in a pill-box containing unnamed small Helicoids and *Diplommatina* in the Blanford Collection. It does not agree in form with *K. vulcani*, G.-A., figured Plate I. fig. 13 of this work.

Kaliella tholus, n. sp. (Plate CLVIII. fig. 10.)

*Locality.* Ootacamund. No. 963, 12.iv.16. Beddome Coll., B.M. (*Colonel R. H. Beddome*).

Shell subperforate, roundly conical, flat on base; sculpture irregular, fine distant and transverse plication, with very microscopic longitudinal striation, especially seen near the suture; colour pale ochraceous; spire pyramidal, apex blunt; suture hair-like, of no depth; whorls 8, sides convex; aperture narrow, semilunate; peristome thin; columellar margin oblique and well reflected.

Size: maj. diam. 4·5; alt. axis 3·1 mm.

Two specimens of this *Kaliella* occurred in an unsorted box of several species, with a label marked "Ooty" in it. It differs considerably from *K. sigurensis*, described and figured by me (Moll. Ind. p. 5, pl. i. fig. 11), in the narrow aperture and much larger size, but assimilates in proportion of its breadth to the height of axis, which is rather greater in the species now described.

Kaliella ? minutissima, n. sp. (Plate CLVIII. fig. 7.)

*Locality.* Avalanche, Nilgiri Hills; in roots of plants, three specimens (*W. T. Blanford*). Blf. Coll. No. 306.06.1.1. B.M.

Shell globosely conoid, rounded below; sculpture microscopic, close transverse ribbing, crossed with spiral striæ, which latter is strong on base; colour dull ochraceous; spire conoid, sides flatly convex, apex blunt; suture impressed.; whorls 5, regularly increasing, the last tumid; aperture semilunate; peristome thin, sharp; columellar margin strong, broad, subvertical.

Size: maj. diam. 2·1; alt. axis 1·4 mm.

Although very globose in form as compared with the usual pyramidal species of *Kaliella*, the sculpture is quite typical of that genus, and into which I have put it provisionally.

Kaliella ? radicita, n. sp. (Plate CLVIII. fig. 12.)

*Locality.* Avalanche, Nilgiri Hills; in roots of plants, three specimens. Blf. Coll. No. 307, 06.1.1. B.M. (*W. T. Blanford*).

Shell imperforate, globosely pyramidal; sculpture, microscopic transverse striation, smooth to the eye, fine spiral striation beneath more distinct; colour pale ochraceous; spire high, sides flat, apex blunt; suture shallow; whorls 5, flatly convex; aperture subquadrate, subvertical; peristome fine; columellar margin vertical, very little reflection.

Size: maj. diam. 2·6; alt. axis 1·9 mm.

This is not the form of a typical *Kaliella*, but it must for the present be put in that genus, until more is known of the animals of these small species.

## Genus Sitala.

(*Continued from* Vol. I. p. 76, 1883.)

? Sitala vaga, n. sp. (Plate CLVIII. fig. 6.)

*Locality.* Avalanche, Nilgiri Hills; in roots of plants, three specimens (*W. T. Blanford*).

Shell globose, imperforate, rounded below; sculpture, fine microscopic longitudinal striation on upper whorls, crossed by irregular ridges of growth, beneath wavy distinct longitudinal striation; colour very pale ochraceous; spire moderately high, apex blunt; suture impressed; whorls 4, convex; aperture semilunate; columellar margin subvertical, reflected.

Size: maj. diam. 2·25; alt. axis 1·4 mm.

This species, most unfortunately, after it was drawn and described, got packed up with some other shells and was taken to the Natural History Museum, and for the present cannot be found.

? Sitala subinjussa, n. sp. (Plate CLVIII. fig. 5.)

*Locality.* Avalanche, Nilgiri Hills; in roots of plants among some other small shells, only one specimen (*W. T. Blanford*). Blf. Coll. No. 308, 06.1.1. B.M.

Shell imperforate, globosely conoid; sculpture, very fine microscopic longitudinal striation, beneath nearly smooth; colour pale ochraceous; spire high, conic, apex blunt; suture impressed; whorls 4, convex, the last tumid; aperture rather narrowly lunate, oblique; peristome thin; columellar margin perpendicular, very minutely reflected.

Size: maj. diam. 4·25; alt. axis 2·6 mm.

I thought at first this was *Sitala? injussa*, but the whorls are fewer, and they do not increase in the same proportion.

Sitala pealii, n. sp. (Plate CL. figs. 4, 4 *a*, radula; Plate CLVIII. fig. 4, shell.)

*Locality.* Naharani, Upper Assam (*S. E. Peal*). G.-A. Coll. No. 2321 B.M. Type.

Shell perforation concealed, globosely conical, with a strong epidermis, well rounded below, keeled; sculpture regular longitudinal liration, crossed by very fine transverse lines, coarse, concentric on base; colour dull ochraceous; spire high, conic, apex fine, sides flat; suture rather shallow; whorls 6, regularly increasing; aperture oblique, semilunate, and fairly broad; peristome thin, the epidermis extending beyond the shell and somewhat thickened; columellar margin curving from the very slight reflection.

Size: maj. diam. 5·25; alt. axis 3·6 mm

Animal with a mucous gland and foot divided, visceral sac plain near branchial sac, dark near apex.

I was fortunate after soaking the dried up animal to get the central portion of the radula. When perfect it must have a very large number of teeth in the row. The three central teeth are slightly larger than those that follow, and are tricuspid, the succeeding teeth are bicuspid, nearly evenly so, and have two small serrations on the outer margin as seen when the teeth are in a certain position.

The shell and its sculpture differs considerably from *S. rimicola* and *attegia*, which it approaches in shape, but its strong keel distinguishes it at once from the first, while it is flatter on the base and has a feeble columella, from the second it is smoother and rounder. It was sent me in spirit by Mr. S. E. Peal with other species some years ago. Peal's death in the prime of life was a great loss—he was clever with his brush and pencil, a lover of nature, and wrote some good descriptions of the Hill country near which his tea garden was situated.

Mr. M. Ogle also obtained this species at Sadia, No. 3280 B.M., and in the Dihing Valley, No. 3278 B.M.

### Subfamily Durgellinæ.

### Genus Durgella.

(*Continued from* Vol. II. p. 293, 1910.)

Durgella naharaniensis, n. sp. (Plate CXXXV. figs. 2–2 *c*.). No. 2320 B.M. Coll.

*Locality.* Naharani, Upper Assam, March 1884 (*S. E. Peal*).

Shell scarcely perforate, very globose, smooth, shiny, very thin and membranous; sculpture to the naked eye, crossed transversely by regular undulations of growth, longitudinally under high power by indistinct striation broken off by the first. Colour bright brown, first whorl at apex white. Spire scarcely rising above the last whorl; suture very shallow; whorls three, rapidly increasing, rounded on the periphery: aperture roundly ovate; peristome thin; columella margin weak, curving inwards.

Size: maj. diam. 6·75, min. 5·4, alt. axis 3 mm.

*Animal* (figs. 2–2 *b*). Foot long, narrow; peripodial fringe broad, regularly grooved, *three* peripodial lines, thus as in *D. assamica.*

Sole very strongly divided, central area narrow. Large pointed overhanging lobe at extremity of the foot. The right shell-lobe elongate and left shell-lobe triangular, pointed, expanding gradually from the edge of the mantle.

The radula is very similar to that of *Durgella mairangensis*, *vide* Vol. I. p. 64, Pl. LXXVII. figs. 7–11 (shell, details of anatomy, and radula).

## Family HELICIDÆ.

An interesting *Eulota*-like *Helix*, comes from Sikhim on the far north near the great glacier from Kanchinjunga, the anatomy of which is near to that of *Eulota*, subgenus *Cathaica*, as given by Pilsbry in his fine work on the Helicidæ in the 'Manual of Conchology,' shown in the shell, the jaw, and radula. It falls also into the distribution of von Möllendorff's section "North and Middle China and Central Asia"; the genitalia, however, are more like those of *Helicostyla butleri*, pl. 54. fig. 8, Man. Conch., with the globular mucous gland. The shells of *Helicostyla* are very different from this Sikhim species.

*Helix radicicola*, Bs., ranges from the N.W. Himalaya to Sikhim; the animal is unknown, but it is not unlikely to be a *Cathaica*.

### Genus Eulota, Hartmann.

Subgenus Cathaica, Möllendorff, 1884, Jahrb. D. M. Ges. p. 339; type *H. pyrrhozona*, Phil.

Eulota (Cathaica) hookeri, n. sp. (Plate CLII. figs. 1–1 *h*.) No. 1147 G.-A. Coll.

*Locality*. Zemo Samdong, Sikhim (*W. Robert*).

Shell (figs. 1, 1 *a*) globosely conoid, rounded below; sculpture none, covered with a strong epidermis; colour umber-brown; spire fairly high, sides flat, apex blunt; suture shallow; whorls $3\frac{1}{4}$; aperture broadly lunate; peristome thin, very slightly reflected on the columellar margin which is oblique.

The aperture was closed with a diaphragm.

Size: maj. diam. 11·3, min. 9·5; alt. axis 9·3 mm.

I name this after Sir Joseph Dalton Hooker, whose name will ever be connected with Sikhim and his admirable account of its physical features, its fauna, and flora in the "Himalayan Journals," 1854.

Animal (figs. 1 *b*, 1 *c*); foot pointed behind, no peripodial groove, surface finely papillate—underside not divided, surface broken into flattened tubercles. The buccal mass (fig. 1 *i*) globular, with a very strong, flat, and broad retractor muscle; salivary gland small.

The *generative organs* (fig. 1 *d*).—The penis is a long, rather slender, cylindrical tube, the vas deferens continuous with it; the retractor muscle, very short to the wall of the bronchial sac, is

given off at a short distance from the head of the penis. The spermatheca is a globose sac on a long thin duct. The dart-sac is globular, short, sessile near the generative aperture, and in transmitted light there was an indistinct appearance of a short pointed dart within it (fig. 1 *e*). The radula (fig. 1 *h*) was not got out in a perfect state (I had only one specimen to deal with), so only the central and admedian were left, all the marginals had gone. The centre tooth is very small and simple, no side cusps; the admedian present a bluntly rounded inner tooth with a very minute cusp on the outer side very similar to *Cathaica pyrrhozona*, Phil., Pilsbry, Man. Conch. pl. 65. fig. 7. The jaw (fig. 1 *g*) is arched and made up of a great number of elongate narrow plates, about 20, twice as many as in *pyrrhozona*, Man. Conch. pl. 65. fig. 8.

Helix (Vallonia?) humilis, Hutton. (Plate CLVIII. fig. 1, shell.)

T. Hutton, J. A. S. B. vol. vii. 1838, p. 217, from Simla.
Pfeiffer (*Helix*), Mon. Hel. vol. i. p. 106.
Reeve (*Helix*), Conch. Icon. f. 825.
Hanley & Theob. (*Helix*), Conch. Ind. 1870, pl. lxi. figs. 4, 5, 6.
Theob. Cat. Supp. 1876, p. 26 (*Vallonia humilis*).

Nevill, Hand-list, 1878, p. 66 (under *Patula*), recorded it from Simla and Murree. Two specimens from Chur, near Simla, coll. F. Stoliczka (this is the Chor Mountain); in his emended copy he distinguishes these as sub-var. *sinistrorsa*. it may possibly be a distinct species. "These are both sinistral specimens. Hutton in his original description records the strange tendency of this form to become reversed; it is interesting that Dr. Stoliczka, after so many years, was able to confirm the observation!" On the other hand I collected a considerable number at Mussoorie, yet have never seen a sinistral example—the same applies to the collection lately received from that hill-station.

Theobald, J. A. S. B. 1881, p. 47 (*Vallonia*), records it from Tundiani, near Murree, as not rare.

For some 30 years I have been in hopes of getting living specimens or specimens preserved in spirit of this small species, of which the generic position was quite unknown. It is plentiful on the limestone rocks at Mussoorie during the rains, in certain localities, and I am at last greatly indebted to my brother-in-law, Major Stratford W. Robinson, R.A., who being there last summer (1911) responded to my request to look for the smaller species of shells. They arrived folded up in blotting-paper, and I was in hopes some of them might still be alive—however, there was no result after placing them in water in a warm place. I then put them to soak, and although the animals softened out I could not find a radula. Finally, however, in one example after it had been six weeks in water in a glass tube, I was able to get both radula and jaw, and am able to give the following description and suggest its relationship.

The radula (Pl. CL. figs. 5 *a*, 5 *b*) has a formula of 12 to 14, 1, 12 to 14. The central tooth has minute basal cusps on both sides; the admedian are all of the same shape on broad plates, a simple tooth with a small outer basal one gradually becoming smaller towards the margin; the last four or five are very minute and undefined, the plates not being visibly separated, so that the minute teeth appear to rise from a continuous narrow plate fining out to the margin. The jaw (fig. 5) is long, and consists of a number of elongate contiguous plates about 24 in number.

There is a certain similarity in the form and number of the teeth of this radula to those of *Punctum*, type *pygmeum*, var. *minutissimum conspectum*, as given by Pilsbry on pl. i. fig. 8 of the 'Manual of Conchology,' 1894. The jaw, however, is very different in the broad rhombic plates, not in the least soldered together, of that species, fig. 9, whereas the jaw of the Himalayan shell is fairly solid.

I am impressed with the idea Mr. Pilsbry puts forward on p. 7, writing on *Punctum*:—"It is evidently a type of vast antiquity and probably has actual affinity to the Neo-Zealandic genus *Laoma*, both may perhaps be regarded as remnants of a Palæozoic fauna." It is quite possible its generic relations go back to pre-Cretaceous times. Portions of the Himalayan on the east and Southern India were then dry land, washed by the Cretaceous sea on both sides of Peninsular India.

The shell of *Helix humilis* is much more discoid than that of *punctum*, and the umbilicus is very open. There is no connection with *Patula*, the jaw in that genus is quite different. Unfortunately we do not know what the animal of this Himalayan species is like, whether there is a peripodial groove or not.

The jaw and radula are both more like what Pilsbry figures on pl. 70. fig. 29 and pl. 70. fig. 38 of *V. pulchella*, and jaw more like fig. 35 *Zoogenites harpa*, Say.

HELIX (ENDODONTA?) ROTUNDUS, n. sp. (Plate CLVIII. fig. 8.)

*Locality*. Ootacamund (*Colonel R. H. Beddome*). No. 964, 12.iv.16. Beddome Coll., B.M.

Shell very globose and very slightly depressed, very finely perforate, flat on base; sculpture, faint irregular transverse plication, with close, regular, microscopic longitudinal striæ; colour dull ochraceous; spire low, apex flatly rounded; suture impressed; whorls $6\frac{1}{2}$, closely and regularly waved; aperture narrowly lunate; peristome thin, reflected on columellar margin, which is very oblique.

Size: maj. diam. 4·25; alt. axis 2·4 mm.

A single specimen of this peculiar little shell occurred among the unsorted lot from Ootacamund, its globose form renders it very distinguishable when it may be found again. I place it provisionally in *Endodonta*.

## Family CYCLOPORHIDÆ.

### Subfamily Alycæinæ.

### Genus Alycæus.

(*Continued from* Vol. II. Part VII. p. 5.)

In Vol. I. pt. V. p. 186 (1886) I gave a short outline of the classification of the subfamily *Alycæinæ*. It now requires amplification, for in the 28 years that have elapsed the number of known species has very greatly increased. It was my hope then to figure the greater number in British India and its frontier-lands. This happily I have nearly accomplished. I have had a magnificent series of the genus to study, for it has been constantly before me when cataloguing for the Natural History Museum the species of Alycæi in the Blanford Collection and in my own. I have been afforded the opportunity of seeing all the rare types and undescribed species in the former, and in the latter tubes and boxes came to hand which had only been very hastily examined at the time their contents were handed to me daily by my native collectors. I must here record and acknowledge with thanks the assistance I have received from Mr. E. A. Smith, of the British Museum, in seeing all the Alycæi in that collection, and included in it were a good many received from Mr. Theobald. My best thanks are also due to Dr. N. Annandale, who, on application to him, sent home from the Indian Museum, Calcutta, all the species I wished to see. These included all that had been recorded by Geoffrey Nevill in his Hand-list (1878); several of these were unnamed and new.

Finally, in the past year or so, I have had the good fortune to go over the collection of Indian Mollusca brought together by Colonel R. H. Beddome, when selecting species which his widow so liberally presented to the Natural History Museum. Among these were many interesting and typical examples of *Alycæus*.

The bringing together of so much material—the habitat of the specimens with few exceptions being undoubted—has led to a far better knowledge of the genus and the limits of the species, an exactitude in distribution seldom obtainable. This has, however, increased the difficulty of forming subgeneric groups, such as the seven sections proposed by Blanford in 1864.

The grouping of the genus *Alycæus* was first attempted by Benson in 1859. There were then known to him only 20 species. He was followed by W. T. Blanford (1864) with 37 species. Next, in 1875, Pfeiffer, and more recently (1897) Von Möllendorff and Kobelt gave their list, much increased in number to 137, of which 64 are species recorded from British India.

Pfeiffer constituted three sections :—

A. *Orthalycæus.*
B. *Charax*, Bs.
C. *Dioryx*, Bs.

A was never described, but in that section the type of the genus *Alycæus*, Gray, comes first.

He divided A into four groups :—

*a*, called "*subpyramidales.*" First species : *gibbus*, Fér. (Pl. CLVI. figs. 5, 5 *a* ; Cochin China).
*b*, called "*globoso vel ovato-conici.*" First species : *pilula*, Gd.
*c*, ,, "*subtrochiformes.*" First species : *vulcani*, Blf.
*d*, ,, "*conoideo-depressa.*" First species : *andamanica*, Bs.

Von Möllendorff and Kobelt (1897) established four divisions—the genus *Dioryx* with 13 species, and three others. This is no improvement on the classification previously put forward if we take, for instance, Blanford's seven sections.

In *a*, subgenus *Orthalycæus* (with 48 species) = Sect. A of Pfeiffer, are to be found included species which Blanford placed in no fewer than five sections, so widely do the shells vary. These are :—

Sect. I. *pyramidalis.* Tenasserim.
II. *constrictus* (type), *bembex*, *otiphorus*, and *graphicus.* Sikhim and Arakan.
III. *vulcani* ("crenulated peristome"). Burma.
IV. *vestitus.* Arakan.
V. *jagori.* Java ?

In *b*, subgenus *Chamalycæus* (with 46 species) similarly :—

Sect. VI. *andamaniæ.* Andaman Islands.
VII. *nitidus.* Arakan.

In *c*, subgenus *Charax* (with 40 species) :—

Sect. III. *succineus.* Arakan.
IV *a*. *crenulatus* (type). Darjiling.
VI. *armillatus.* Pegu.
VII *a*. *avæ.* Burma.
VII *b*. *hebes.* Khasi.

In *Charax* greater variation in the species may be noted than in the previous division.

*Dioryx* of Benson holds its own, and at first sight *Charax* appears to form a good section in which several species can be placed without misgiving ; but we soon have to deal with species in which the constriction departs greatly from that of typical *hebes*, and further subdivision has to be considered. Take, for

example, *A. strangulatus* (Pl. CXXXVI. figs. 1, 1 *a*), which has been placed in *Charax*, and compare it with *A. hebes* (Pl. CXLV. figs. 5–5 *b*), the type. The ridge crossing the whorl is in a different position with respect to the aperture, and differs altogether in its shape; much the same can be said of other species placed in *Charax*. Blanford made *A. strangulatus* the type of his Section VII. and he says very truly (bottom of p. 458, A. M. N. H. June 1864) concerning the constriction: "That it may be doubted whether the form of this one portion of the shell is sufficient for a division of the genus." It seems the best course not to use the character in this sense in this monograph of the British Indian species, so great is the variation of other parts.

Gray's type of the genus—*A. gibbus*, Fér. (Pl. CLVI. figs. 5, 5 *a*), from Cochin China—has only one representative (*A. pyramidalis*, Bs.) in Tenasserim. Species are very restricted in their geographical distribution; every fresh area produces new forms, different to any seen before, recently well exemplified in the species discovered by Lieut. G. F. T. Oates, R.E., in the Abor Hills, Assam, and far up the Tsanspu valley. One of these is so diverse in structure from all known to me before that a new subgenus becomes necessary for its reception, which I name *Raptomphalus* and describe further on. It will be interesting to see what may be the extent of its range and what direction it may take from lat. 28° 30′ and long. 95° 15′.

I must refer now to what I wrote after *Dioryx* in vol. i. p. 187 (1886): "Another well-marked section quite as worthy of subgeneric distinction is No. II. of Blanford" (1864), by him unnamed, although described and the type *A. constrictus* specified.

*Original description*:—"Shell perforated, ovately conical, sculpture consisting of very few ribs on the inflated portion of the shell; sutural tube very short"; and in this section he placed *constrictus*, Bs., *bembex*, Bs., *otiphorus*, Bs.—all from Darjiling, and *graphicus*, Blf., from Arakan.

For this section I propose the name

### Subgenus Cyclorysx, nov.

Shell perforate, ovately conoid, sculpture generally consisting of distant, fine, regular costulation on the upper whorls, stronger and closer on the short inflated portion of the last. Sutural tube extremely short, or as often clubbed or pear-shaped.

I have a paper left me by Wm. Blanford, never published, with the title "Notes on the Land-Shells of Darjiling." It contains some interesting remarks. Many species are described very fully in Latin, and several MS. names occur which never became established. I infer the paper was never published, because these species were at about the same period described by Benson. Quite at the end of the paper he says: "Generally the most marked character of the fauna is the very large number of representatives

of the genus *Alycæus*, the number being nearly if not quite equal to all the other known truly Indian species of that singular form. It is highly probable that many more forms may yet be procured from this region. As already mentioned, there are several species of my own collection as yet undescribed, and the general distribution of shells is so excessively local that any diligent collector may add largely to the number. All the hills and valleys of Independent Sikhim are completely unexplored so far as the mollusca are concerned, and the neighbouring regions of Nepal and Bhotan are yet a *terra incognita*."

This was written some 50 years ago, and although Sikhim has been since well worked, the two neighbouring areas still remain a blank as respects the land mollusca.

William Blanford, writing when on his first visit to Darjiling and after collecting there, says: "There seems in very many indeed of the Sikhim species of shells to be a tendency to occur in two varieties, one conspicuously smaller than the other. This has been already remarked in the case of *Helix plectostoma, H. trigurium*, and *Achatina tenuispira*, and it is equally true of *Streptaulus blanfordi, Alycæus otiphorus*, and *Achatina crassilabris* or *crassula*, and some others." It is most marked in some of the Khasi Hill shells, notably in *Spiraculum hispidum* at Teria Ghat.

In the 'Journal of the Asiatic Society of Bengal' (1874) I wrote: "The Alycæi particularly seem to be inexhaustible; the different species are very local but very persistent in character over comparatively small areas, and as they are generally abundant where they occur, the idea that they are accidental varieties is not supported. Very few have a wide vertical distribution, and some common forms of the Khasi Hills, at a distance of some 120 miles east in the Naga country, are absent or become very rare indeed. The whole section is a most interesting one, and illustrates admirably the many changes that nature will ring on any particular form of life where confined to particular habitats suitable for their development, and again subjected to all the slow alternations in climate, soil, &c. that time produces." "Several species of Alycæi, when taken in a fresh state, are found covered with a coating of earthy matter, sometimes black, rendering them very indistinct and difficult to find, especially as they are to be generally found below the surface and beneath the dead leaves and decaying bark and sticks that cover the ground so thickly in virgin forest. Dead shells may be sometimes seen in hundreds in the clearings after the cut jungle has been fired, when the surface vegetable mould is burnt and the ground heated to a great depth. In this way many local forms of land-shells must be destroyed off many a large area as the country becomes cleared, and many of the more local species have no doubt thus died out."

## Distribution of the Genus *Alycæus* in British India.

### 1. *North-West Himalaya.*

| | Plate & fig. |
|---|---|
| *Alycæus strangulatus*, T. Hutton. | Pl. CXXXVI. figs. 1, 1 *a*. |

No species as yet collected in Nepal.

### 2. *Sikkim and the Teesta Valley, with Western Bhutan.*

Long. 88° to 89° East.

| | |
|---|---|
| (*Cycloryx*) *bembex*, Bs. Type. | Pl. CXLVII. figs. 1, 1 *a*. |
| (*Cycloryx*) *constrictus*, Bs. Type. | Pl. CXLVII. figs. 4, 4 *a*. |
| *crenulatus*, Bs. | Pl. CXXXIII. figs. 1–1 *c*. |
| *dalingensis*, n. sp. | Pl. CXXXIV. figs. 3–3 *c*. |
| *damsangensis*, G.-A. =*subnotatus*, Nev. MS. | Pl. XLIII. figs. 3–3 *c*. |
| *digitatus*, H. Blf. | Pl. CXXXIV. figs. 5, 5 *a*. |
| *fimbriatus*, W. Blf. MS. =*digitatus*, a small variety. | |
| *gemmula*, Bs. | Pl. XLVIII. figs. 4–4 *c*. |
| *lectus*, n. sp. Type Indian Mus. | Pl. CXXXVI. figs. 5, 5 *a*, 5 *b*. |
| *lenticulus*, G.-A. Type Indian Mus. | Pl. CXXXVI. figs. 2, 2 *a*. |
| *lenticulus*, G.-A. | Pl. CXXXVI. figs. 4–4 *b*. |
| *montanus*, Nev. Type Indian Mus. | Pl. CXXXVI. figs. 3, 3 *a*. |
| (*Cycloryx*) *otiphorus*, Bs. | Pl. CXLVII. figs. 2, 2 *a*, 2 *b*. |
| *physis*, Bs. | Pl. CXXXIV. figs. 1, 1 *a*. |
| *plectocheilus*, Bs. | Pl. CXXXIV. figs. 4–4 *c*. |
| *plectocheilus*, Bs., var. | Pl. CXXXIII. figs. 3–3 *c*. |
| *rechilaensis*, n. sp. | Pl. CXXXIV. figs. 2, 2 *a*. |
| *stylifer*, Bs. | Pl. CXXXIII. figs. 2–2 *c*.<br>Pl. CLV. fig. 8. |
| (*Cycloryx*) *summus*, n. sp. | Pl. CXLVII. figs. 3, 3 *a*. |
| (*Dioryx*, Blf.) *urnula*, Bs. Typical. | Pl. CLIII. figs. 1, 1 *a*. |
| *urnula*, Bs., large var. | Pl. CLIII. fig. 2. |

From 89° to 93° or 4 degrees of Longitude we know nothing of the Molluscan fauna.

### 2 *a*. *Eastern Bhutan.*

Probably near the Aka Hills.

| | |
|---|---|
| *Alycæus bhutanensis*, n. sp. | Pl. CXLVIII. fig. 8. |
| *commutatus*, n. sp. | Pl. CXLVIII. fig. 7. |

### 1. *North-West Himalaya.*

The valleys of the Jumna, Ganges, and Kali to Nipal.

ALYCÆUS STRANGULATUS, T. Hutton. (Plate CXXXVI. figs. 1, 1*a*.)

Pfeiffer, Zeitschr. für Malak. 1846, p. 86; id. Mon. Pneum. vol. i. p. 120; Küster ed. Chemn., *Cyclostoma*, pl. 17. figs. 7 & 8, and pl. 38. fig. 35; Benson, A. M. N. H. iii. 1859, p. 177 (sec. 2, *Charax*—subsec. **); Blanford, A. M. N. H. June 1864, p. 458 (section vii—type of a subsection, a ridge crossing the constriction not recurved; shell depressed); Hanley, Conch. Ind. pl. xciii. figs. 2 & 3 (1870); Theob. Supp. Cat. p. 40 (1876); Nevill, Hand-l. i. p. 290 (1878); Von Möllendorff & Kobelt, Nachrbl. Deutsch. Malak. Ges. 1897, p. 149 (sec. *Charax*).

In a paper entitled "Nachtrag zur Revision der Gattung Cyclostoma," by Dr. L. Pfeiffer, he describes *Cyclostoma strangulatum*, Hutton, as follows:—

"T. late umbilicata, depressa, subdiscoidea, tenuis, subtilissime costulato-striata, corneo-hyalina; spira vix elevata, obtusiuscula; anfr. 4, convexi, ultimus latere inflatus, prope aperturam strangulatus, antice angustatus; apertura obliqua, circularis; perist. simplex, album, sat incrassato-expansiusculum, marginibus approximatis, callo junctis. Operc. membranaceum multispirum. Diam. $4\frac{1}{2}$, alt. $2\frac{1}{2}$ mill.

"Habitat in Bengalia (*v. d. Busch*)."

The shell is carried high in the air, and clear of the foot, showing a strong muscular power in the neck. A movable orange spot is apparent in the head, and which moves down to the snout. I once succeeded in passing a hair through the sutural tubes or callus into the aperture of the shell.

This description was made by Mr. Benson from specimens of *Alycæus strangulatus* taken at Landour in 1842. *Strangulatus* is described in Zeitschr. für Malak. 1846, p. 86, and Conch.-Cab. p. 104; amended, Zeitschr. 1851, p. 7; and for *constrictus*, Ann. Nat. Hist. vol. viii. p. 188 (1851), and for amended description vol. x. p. 272 (1852).

The specimen I have figured is from the typical locality Mussoorie (number 2501, B.M. Coll.). In Kumaon specimens the costulation is finer all over and not so defined and distant near the sutural tube. General form of the tube the same, the swelling near the constriction higher. From Naini Tal specimens are of similar character.

### 2. *Sikkim and the Teesta Valley, with Western Bhutan.*

Includes Darjiling, down to the base of the hills.

ALYCÆUS CRENULATUS, Benson. (Plate CXXXIII. figs. 1–1 *c*.)

A. M. N. H. ser. 3, vol. iii. 1859, p. 180; Pfr. Mon. Pneum. vol. iii. p. 55; Hanley, Conch. Ind. 1870, p. 39, pl. xcvii.

figs. 1 & 4 (not good); Theob. Supp. Cat. 1876, p. 39; Nevill, Hand-l. i. 1878, p. 295.

Original description:—"*Testa umbilicata, depresso-turbinata, dense oblique costulata; spira conoidea, sutura profundiuscula, apice papillari; anfractibus 4 convexis, ultimo rotundato, ad latus inflato, eo costulis confertioribus ornato, tum juxta peristoma breviter constricto, lævi, tubulo suturali elongato non procul ab apertura oriente munito; apertura vix obliqua, circulari; peristomatis labro, subduplici incrassato, exteriore reflexo, interiore crenulato quadriplicato aperturam vix coarctante, labio simplici, tenui, marginibus callo crasso prominente junctis. Umbilico profundo, margine rotundato.*

"Operculo ——?

"Diam. major 4, minor $3\frac{1}{3}$, axis 3 mill.

"Habitat in valle Rungun."

"The constriction of the last whorl is near the aperture, without any intermediate ridge or swelling, in this respect showing an affinity with *Amphora* and *Urnula*. In the crenulation of the peristome it exhibits an analogy with *sculptilis* of the normal group, in which the crenulations are twelve in number, with the origin of the sutural tube remote from the aperture.

"The specimens examined are all weathered and bleached. It is a singular circumstance, that each of the three natural sections of *Alcyœus* should have an analogical connexion through the plicate peristomes of *sculptilis*, *plectocheilus*, and *crenulatus*. The genus *Pterocyclos*, as above noted, has also its analogical representative of the form in *P. bilabiatus*; and it is worthy of remark that it claims affinity with *Alycœus*, as well as with *Opisthoporus*, through the aberrant *P. hispidus*, Pearson, which exhibits a retroverted sutural siphon, although the stricture of the operculum, which is very similar to that of its siphonless near relative, *P. tenuilabiatus*, Metcalfe, confirms its location among the *Pterocycli*."

The specimen figured (No. 1254 B.M.) from Damsang, Western Bhutan, differs somewhat from specimens I have come across in Blanford's collection, No. 962, *crenulatus*, var. marked Namgu, 2500 ft., and Lingtam, Sikhim, 4000 ft., in having much stronger higher costulation. There are 22 from the two localities but put together in one pillbox. Ten of these have the crenulated peristome, but 12 show no trace of it, although most are apparently fully grown. Whether this variation is distinctive of one or the other of the above localities it would be interesting to clear up.

ALYCÆUS DALINGENSIS, n. sp. (Plate CXXXIV. figs. 3–3 *c*.)

*Locality.* Rechila Peak, Daling District, on Sikkim and Bhutan Boundary (10,300 ft.). No. 1251 B.M. Type.

Shell narrowly umbilicated, globosely conoid, rather solid; sculpture smooth on upper whorls, costulation near sutural tube close in low relief, the tube moderately long; colour dull ochraceous; spire moderately high, sides flat, apex rather blunt; suture impressed; whorls 4, rounded, regular in increase, constriction

close to base of sutural tube, swelling at once towards the aperture, which is circular, with a nick or angle on the upper inner margin; peristome simple, double, reflexed, curving on the columellar margin side.

Size: maj. diam. 3·4; alt. axis 1·7 mm.

This has a close resemblance to *A. lenticulus*, but it differs in its general shape and the aperture from that species obtained in the neighbourhood of Darjiling, two examples of which I have given figures of.

ALYCÆUS (CHARAX) DAMSANGENSIS, G.-A.

Moll. Ind. vol. i. (1886), p. 192, pl. xliii. figs. 3, 3 *a*, 3 *b*, 3 *c*. No. 2677 type.

This is *subnotatus*, Nevill MS., Hand-list, emended copy, no. 51, p. 294; 1 specimen *ex* coll. Dr. F. Stoliczka.

This single specimen having been sent to me from the Indian Museum, Calcutta, I was able to compare with the type and determine as above.

ALYCÆUS DIGITATUS, H. F. Blanford. (Plate CXXXIV. figs. 5, 5 *a*.)

Henry F. Blanford, J. A. S. B. vol. xl. (1871) p. 41, pl. ii. figs. 4–4 *b*; Hanley & Theob. Conch. Ind. footnote, p. xiii, no figures; Theob. Supp. Cat. 1876, p. 39; Nevill, Hand-l. i. (1878) p. 294.

Specimen figured came from the Rechila Peak, in the Western Bhutan Hills, south of Sikhim (No. 1253 B.M.). A typical specimen was received by me from Mr. Henry Blanford, and is now in the B.M. Collection, No. 2506.

Original description:—"*Testa solida, depressa turbinata, umbilicata, albido-cornea, regulariter costulata; pone aperturam usque ad tubulum striata spira parum exserta, apice obtusulo. Anfractus 4, rotundati; ultimus inflatus, deinde constrictus, iterum abrupte expansus, denique abrupto constrictus, antice depressus et in 5 plicationes validas desinens. Tubulus post constrictionem oriens, recurvatus, $\frac{1}{6}$ anfractus subæquans. Sutura impressa. Apertura perobliqua. Peristoma duplex; externum simplex, evertatum; internum continuum, superne valde prolongatum, 5 plicatum. Plica basalis abrupto recurvuta. Operculum corneum, extus concavum.*

"Alt. 3·6 mm. Diam. major 5·5; minor 4 mm.

"Apertura alt. 2·25, lat. 2·75 mm.

"Habitat apud Darjeeling in vallo Rungno fluminis Himalayæ Sikkimensis.

"Of all the *Alycæi* yet discovered with plicate peristomes, this exhibits the character in the most exaggerated degree; the free portion of the lip being prolonged into 5 digitiform folds nearly a millimetre in length. The ridge-shaped fold between the two constricted portions is very abrupt, as in *Alycæus plectocheilus*,

which species, together with a yet unpublished form found by Major Godwin-Austen in the Khasi Hills, are its nearest allies. In some specimens, taken alive, the costulation has disappeared from the greater portion of the upper whorls, and remains only in patches; so that on a cursory inspection, the whorls appear to be smooth and striate: it is most distinct on the inflated portion of the shell.

"I found a single specimen of this shell in 1856, in the Rungno Valley. Some years afterwards I received several specimens from Mr. W. S. Atkinson, which were taken, I believe, near the station of Darjeeling."

In W. T. Blanford's collection there are two specimens (No. 48.06.4.4) named *A. fimbriatus*, a MS. name, for I have failed to find it alluded to in any paper by Blanford. The specimens are bleached and poor and represent a dwarf variety of *A. digitatus*, H. Blf., found in a neighbouring valley to Darjiling, the Rungun.

Alycæus (Charax) gemmula, Bs.

Moll. Ind. vol. i. (1886) p. 190, pl. xlviii. figs. 4–4 *c*.
Nevill's Hand-list, p. 294, no. 49, *Alycæus*, n. sp.

"6, Rungun Valley, Darjiling, *ex* coll. Dr. F. Stoliczka & Col. G. B. Mainwaring," is this species, which I have now seen and compared with the type in Mr. W. T. Blanford's collection (No. 55.06.4.4 B.M. Coll.).

Alycæus lectus, n. sp. (Plate CXXXVI. figs. 5, 5 *a*, 5 *b*, type.)

No. 48, Nevill's Hand-list, p. 294, n. sp.

*Locality*. Chaukkatan (near Darjiling), no. 48, Nevill, Hand-list, p. 294, *ex* coll. F. Stoliczka.

Shell conoid, rather solid; sculpture very much obliterated, fine distant costulation, some fine and close behind the sutural tube, which is rather short, 0·09 mm.; colour (an old shell, much worn); spire depressedly conic, apex blunt; suture impressed; whorls 4, increasing regularly, constriction very narrow, the last swelling very slightly, and distance to the aperture very short, only 1 mm., angulate below next the umbilical region; aperture circular, oblique; peristome double, thickened.

Size: maj. diam. 3·3; alt. axis 1·8 mm.

Only a single specimen is in the Indian Museum, Calcutta; it is allied to *A. lenticulus*, but has distinctive characters.

Alycæus lenticulus, G.-A. (Plate CXXXVI. figs. 2-2 *a*, types.)

J. A. S. B. vol. xliii. 1874, p. 147, not figured.
No. 48, Nevill's Hand-list, p. 294.

*Locality*. Darjiling.

Shell conoid, moderately umbilicated, globosely conoid; sculpture

not well seen, fine costulation near sutural tube, which is rather short, only 0·075 mm. long; colour bleached; spire conic, rather high, apex blunt; suture rather shallow; whorls 4, very evenly increasing, the constriction slight, short, then swelling gradually towards the aperture; aperture very oblique, ovate, straight on outer margin, rounded on the columellar side, angular above; peristome double, very slightly thickened.

Size: maj. diam. 3·4; alt. axis 1·4 mm.

This is the species, No. 48 of Nevill's Hand-list, p. 294, labelled by me *lenticulus* but never described. only one specimen collected by Ferd. Stoliczka. It has been sent home from the Indian Museum, Calcutta, and I am now able to figure and describe it after 35 years, for which I am indebted to Dr. N. Annandale, who has sent me all the undescribed species in the collection. This is the specimen alluded to in the Journal of the Asiatic Society of Bengal above quoted. I then wrote: "I have an *Alycæus* from Darjiling found by Mr. F. Stoliczka, but as I possess but a single much worn specimen I hesitate to describe it more fully; it is very similar to *A. theobaldi*, Bs., from the Khási Hills, but is smaller with a more expanded aperture; peristome less thickened, and the sculpture appears to have been very fine; I name it *A. lenticulus*, and trust some day to get other specimens."

No. 49 of Nevill's Hand-list, p. 294, has also been sent (6 specimens) from the Stoliczka collection; they are, I consider, *A. lenticulus*, and three are adult shells, of which I figure one (Pl. CXXXVI. figs. 4–4 *b*), as the type specimen is certainly not fully grown. This specimen is more globose, the peristome much thickened, and shows fine close costulation contiguous to the sutural tube.

This species proves to be most abundant on Rissom Peak, in the Western Bhutan Hills (No. 2552, B.M. Coll.).

Alycæus montanus, G. Nevill. (Plate CXXXVI. figs. 3, 3 *a* of type.)

Journal Asiat. Soc. Bengal, vol. l. pt. 2, 1881, p. 149, pl. vi. fig. 5.

No. 50, Nevill's Hand-list, p. 294.

1. Sikhim, 11,000 ft., *ex* coll. Dr. F. Stoliczka.

*Original description*:—"Openly and widely umbilicate, much depressed, solid, bright corneous brown, closely, evenly, and regularly ribbed. ribs somewhat superficial, scarcely flexuous, close set, for a short distance at the sutural tube more crowded and more strongly developed; spire scarcely elevate, apex obtuse; whorls 4, regularly evenly rounded, constriction scarcely defined, sutural tube short (about 1 mm.); aperture circular, peristome slightly thickened, but not double; operculum thick, black, and concave.

"*Hab.* Sikhim, at 11,000 feet.

"Diam. $5\frac{1}{4}$, alt. $3\frac{1}{10}$ mm.

"A well marked form, reminding one of *A. expatriatus*; the depressed form, very open umbilicus, and scarcely distinguishable constriction, all good characters."

The sculpture and coloration is very similar to that of *A. strangulatus*.

Alycæus physis, Bs. (Plate CXXXIV. figs. 1, 1 *a*.)

A. M. N. H. ser. 3, vol. iii. 1859, p. 179; Pfr. Mon. Pneum. vol. iii. p. 48; Hanley, Conch. Ind. p. 38, pl. xcii. figs. 5–6; Theob. Supp. Cat. p. 40; Nevill, Hand-list, p. 294, No. 53.

Original description:—"*Testa mediocriter umbilicata, conoideo-depressa, tenui, regulariter planato-striata, striis opacis, minime elevatis, confertissimis, ad umbilicum perspectivum nonnullis elevatis acutis, hyalina, nitida; spira brevi, apice subpapillari, sutura impressa; anfractibus 4 subconvexis, ultimo ad latus, pone constrictionem, valde inflato, tubulum suturalem elongatum gerente, pone labrum tumidiusculo; apertura obliqua, subcirculari, peristomate duplici, interno breviter expanso, incrassato-reflexo, externum celante, marginibus callo parietali expansiusculo semicirculari junctis.*

"Operc. —— ?

"Diam. major 10, minor 8; axis 6 mm.

"Habitat in valle Rungit (alt. 2000 ped.) prope Darjiling, rare occurrens.

"Larger than the Khasia *A. prosectus*, from which it is abundantly distinguished, by the characters of the aperture, the less mucronate spire, its peculiar striation and lustre, shorter sutural tube, and the greater inflation of the whorl. In *prosectus* the space between the constriction and the aperture is suddenly tumid near the constriction, the swelling decreasing towards the peristome; in *Physis* the swelling increases gradually towards the mouth, which is not inclined to be so very oblique. There are faint indications of spiral sculpture evident in the facet-like appearance of the surface. Within the umbilicus, near the inflated part, every fourth or fifth of the scarcely elevated striæ (which would elsewhere be hardly distinguishable except for their white opacity on the hyaline ground) is raised into a knife-like edge.

"In size and form *A. physis* nearly approaches *umbonalis*: but the colour, opaqueness, great solidity, and the more moderate inflation of the last whorl, in addition to the more remote constriction, and the very different sculpture presented by the Burmese species, preclude any danger of confounding it with its Himalayan ally."

The specimen figured came from Western Bhutan (No. 2773, B.M. Coll.); it measures: major diameter 9·75; alt. 3·5 mm.

Alycæus plectocheilus, Bs. (Plate CXXXIV. figs. 4–4 *c*.)

A. M. N. H. ser. 3, vol. iii. 1859, p. 180; Pfr. Mon. Pneum. vol. iii. p. 53; Hanley, Conch. Ind. p. 39, pl. xcvi. figs. 5 & 6, too small; Theob. Supp. Cat. p. 40; Nevill, Hand-list, No. 52, p. 294.

The Darjiling specimen figured is a typical one from the Blanford collection.

Original description:—"*Testa aperte umbilicata, depresso-turbinata, confertim striatula, striis nonnullis ad suturam elevatis, nitente, subpellucida, rufescenti-albida; spira brevi, depresso-conoidea, apice obtuso, sutura impressa; anfractibus* $3\frac{1}{2}$ *convexis, ultimo rotundato, profunde constricto, tubulum mediocrem gerente, strictura crista angusta elevata, intus cavo-sulcata, peristoma expansum simulante, ab apertura separata; apertura vix obliqua, subcirculari, peristomate duplici, margine columellari leviter incrassato-reflexo, dextrali valde incrassato-porrecto, fortiter acutangulatim crispo-plicato, plicis quinque aperturam arctantibus, marginibus callo prominente anguluto junctis.*

"Operc. —— ?

"Diam. major $2\frac{1}{2}$, minor 2; axis vix 2 mm.

"Habitat in valle Rungun.

"The dimensions given are those of the largest of four specimens. The strennously vandyked plication of the incrassate edges of the porrect dextral side of the peristome is a remarkable feature in this minute species. It recalls the curious frill in *Pterocyclos bilabiatus*, Sow., but in a more exaggerated guise, notwithstanding the smallness of the shell. The edges of the folds are thickened and slightly reflected. Its smaller size, sculpture, and wider umbilicus, and, above all, the mode of constriction, prove that it is not an exaggerated form of *crenulatus*. The deceptive appearance of the ridge or crest at first induced me to class the shell with *Dioryx*; but a closer investigation of the mode in which the ridge was attached to the true peristome, and a view of the internal sulcus, revealed the true position of the species."

Alycæus plectocheilus, Bs., large var. (Plate CXXXIII. figs. 3–3 *c*.)

Damsang Peak, Western Bhutan (No. 1256 B.M. Coll.).

Major diameter 3·75; alt. axis 1·6 mm.

Of the typical specimen figured—

Major diameter 3·20; alt. axis 1·5 mm.

The operculum of this specimen is multispiral, smooth and black.

Alycæus rechilaensis, n. sp. (Plate CXXXIV. figs. 2, 2 *a*.) No. 1252 B.M. Coll.

*Locality*. Rechila Peak, Daling District, on Sikhim-Bhutan Frontier, 10,300 feet.

Shell *very openly umbilicated*, depressedly conoid, *covered with a strong epidermis*; sculpture: *costulation strong, very close and regular on upper whorls, still more so next sutural tube where* 21 *ribs can be counted, the tube is rather short*; colour ochraceous with a green tinge; spire low, apex small; suture well impressed; whorls 4, tumid, sides rounded, the distance from the constriction to the aperture is not great and *is crossed just behind it, by a well-defined*

*ridge of regular breadth*; aperture *circular*, obtusely angulate on upper inner margin; peristome simple, double, not reflected; operculum *black, multispiral, concave, whorls rough and raised above each other.*

Size: maj. diam. 5; alt. axis 2·75 mm.

Only one example occurred on this peak, which is so conspicuous from the terai at the base of the hills; its characters are so distinct from species known to me that I name it, as I feel sure it will be found again.

Alycæus stylifer, Bs. (Plate CXXXIII. figs. 2–2 *c.*) No. 1255 B.M. Coll.

Benson, A. M. N. H. ser. 2, vol. ix. March 1857, p. 204; Pfeiffer, Mon. Pneum. vol. ii. p. 37; Novit. vol. i. pl. 35, figs. 24–27; Hanley & Theob. Conch. Ind. 1870, p. 38, pl. xcii. figs. 1, 4; Theobald, Cat. Supp. p. 30; G. Nevill, Hand-list, i. 1878, p. 294.

Original description:—"*Testa umbilicata, depressa, confertim striatula, ad spatium inflatum confertissime acute costulata, nitente, albida; spira brevi, mucronata, apice obtusulo, sutura profunda; anfractibus 4 convexis, ultimo pone stricturam gibbo, tubulum mediocrem gerente, medio stricturæ costam prominentem (intus concavum) exhibente; apertura obliqua, subcirculari, irregulari, sinuata, peristomate simplici, incrassato-reflexo.*

"Operc. —— ?

"Diam. maj. $5\frac{1}{2}$, min. $4\frac{2}{3}$; axis $3\frac{1}{3}$ mill.

"Habitat ad Darjiling. Teste H. Blanford.

"The rib behind the outer lip corresponds with a deep sulcus within the aperture. A similar feature is observable in the little Bornean *Alycæus spiracellum*, A. & R., and in the following species (*hebes*). The single specimen from which the description above given was made is a dead and discoloured shell. The two *Alycæi* previously known to inhabit Darjiling are of the pupiform type"

The example figured is not from the typical locality Darjiling, but from Damsang in the Daling District, east of the Teesta, known as Western Bhutan until it came under our rule after the Bhutan campaign in 1864–66. I am able to compare it with a typical specimen, No. 2503 B.M., given to me by Henry Blanford its discoverer; they are not absolutely identical. The Darjiling form is the largest, the sutural tube is longer, and the costulation next it far coarser.

Size of Damsang specimen: major diam. 5·0; alt. axis 2·5 mill.

Dr. O. von Möllendorff described the following under a MS. name of G. Nevill's:—

Alycæus (Charax) subhumilis, Nev.

Nachrbl. Deutsch. Malak. Ges., March–April 1897, p. 41.

Original description:—"*T. anguste umbilicata, depresso-globosa, solidula, subpellucida, subtiliter striatula, costulis valde distantibus deciduis sculpta. Spira convexo-conoidea sursum rubella. Anfr.*

4 *convexi, ultimus a medio tumidus, basi gibbus, tum valde constrictus, post stricturam crista valde elevata, cinctus. Apertura modice obliqua, subcircularis, peristoma extus sat expansum valde incrassatum, quasi multiplicatum, intus porrectum, vix expansum, ad insertionem et basi sinuatum, sat excisum.*

"Diam. 2·8; alt. 2·2 mill.

"Hab. in montibus Darjiling Indiæ. Comm. Cl. R. Hungerford."

This was evidently a MS. name of Nevill's. See his Hand-list, p. 291, no. 11, *Alycæus*, n. sp. (prox. *A. humilis*), 20 Darjiling, coll. Dr. F. Stoliczka. In Nevill's own copy he has entered Col. Mainwaring also. These were not included among the Alycæi sent to me by Dr. Annandale, but specimens from Cachar (?) c. Dr. F. Stoliczka, were sent, and these I determined to be *A. nongtungensis* mihi.

### Subgenus Dioryx, Benson.

A. M. N. H. March 1859, p. 177, for original description.
Moll. Ind. vol. i. p. 187.

Alycæus (Dioryx) urnula, Bs. (Plate CLIII. figs. 1, 1 *a*.)

Specimen figured, No. 40 Blf. Coll., Rungun Valley, the typical locality.

Benson, A. M. N. H. ser. 2, vol. xi. 1853, p. 284.

Original description:—"*Testa rimata, vix perforata, globoso-conica, lævigata, sordide albida, apice obtusiusculo, rubescente, sutura impressa, callum gerente; anfractibus $3\frac{1}{2}$ convexis, ultimo ventricoso, exilissime radiato-striato, pone aperturam breviter constrictiusculo, proxime tubam retroversam, suturalem, elongatam, emittente; apertura circulari verticali integra, peristomate incrassato, subduplicato, expanso, subreflexo, breviter adnato; operculo aperturam æquante, planato, anfractibus mediocribus, subconspicuis.*

"Diam. $3\frac{1}{2}$, alt. $4\frac{1}{2}$ mill.

"*Hab.* Ad Darjiling Himalayanum. Testa Dom. R. Trotter."

"This interesting species inhabits the same locality as *A. constrictus*, described in the tenth volume of the 'Annals,' but differs in form and sculpture and in the position of the sutural callus. The strangulation is less conspicuous than in other species of *Alycæus*, and the constriction occurs immediately behind the peristome; hence the sutural callus also commences near the aperture instead of being remote as in the other species. A brown mark, in the single specimen which has come to hand, occurs at the point where the callus is given off. The callus lying in the suture is also longer than in the orbiculate *A. strangulatus*, in which it is moderate, or in *A. constrictus*, where it is short. The number of whorls in the operculum of *A. strangulatus* is much greater, and they are more compactly wound than in either *A. urnula* or *constrictus*; in *A. urnula* the sutures are tolerably distinct, and the central whorls are slightly concave; in *A. constrictus*, the sutures are inconspicuous, as originally noted."

On page 284 Mr. Benson gives an excellent description of the animal:—"*Alycæus*, Gray. Tentacula duo mediocria, cylindracea, apicibus obtusis, oculos ad basin posteriorem ipsa gerentia; oculi integri, circulares, nigri minuti (quasi puncta), vix prominentes. Pes brevis, postice ultra testam non transiens, operculum testaceum concaviusculum multispiratum, sursum ad dextram gerens."

A. URNULA, No. 2589. Large variety. (Plate CLIII. fig. 2.)

From Darjiling, I find among Blanford's specimens, one large variety, and I have another in my own collection from Damsang, Daling District, east of the Teesta, equally large; it quite approaches *A. amphora* in size; the sutural tube is 2 mm. long, and the costulation close and regular. In form it has the elongate finer spire of the smaller, much more numerous, typical shell and cannot be separated.

I have *Dioryx urnula* from many widely separated localities; a close examination of them all, presents much interesting variation from the typical form found at Darjiling and Sikhim, which has fine costulation.

In the Dafla Hills, in three specimens from Niosi Purbet (No. 2600 B.M.), described further on as var. *daflaensis*, I find the sutural tube very short, only 1·6 mm., compared with the remarkably long one in typical *urnula* from Darjiling.

The same difference is found in two specimens from Toruputu Peak, with fine costulation, No. 2599 B.M.

Examples from Brahmakund, No. 2532 B.M., are more globosely tumid than type, with stronger peristome and stronger, more distant costulation.

From the Habiang Garo Hills, to S.W. of the Khasi Hills, No. 2524 B.M., there is very fine close costulation.

Anghami Naga, No. 2529 B.M. 18 specimens. Sutural tube long, 2·4 mm., costulation fine but more distant.

From Nongjinghi, No. 2526 B.M. a high Trigonometrical Station on the north side of the Jaintia Hills. The general shape is nearest to the Anghami shells.

Only a single specimen occurs from Munipur, No. 2549 B.M. The apex is blunt, small and pink, and the costulation very fine indeed, and is the smallest variety I have seen.

### Subgenus CYCLORYX, G.-A.

ALYCÆUS (CYCLORYX) BEMBEX, Bs. (Plate CXLVII. figs. 1, 1 *a*.)

Figure of type, No. 44 Blanford Collection—Darjiling.
A. M. N. H. ser. 3, vol. iii. (1859) p. 178.
Pfr. Mon. Pneum. vol. iii. p. 46.
W. T. Blf. Ann. & Mag. Nat. Hist. June 1864, p. 458, section ii.
H. & T. Conch. Ind. 1876, p. 39, pl. xcv. figs. 2, 3.
Theobald, Cat. L. & F. W. Moll. B. I. 1876, p. 39.
Nevill, Hand-l. i. 1878, p. 294.

Original description :—" *Testa umbilicata, ovato-conica, lævigata, hic illic striatula, striis ventriculi confertis, ad umbilicum striatula, hyalina ? ; spira elevato-conica, sutura profunda, apice acutiusculo ; anfractibus 5, valde convexis, ultimo compresso-rotundato, pone stricturam modice tumido, tubulum suturalem brevissimum gerente, pone aperturam rursus tumidulo ; apertura obliqua, subcirculari, peristomate simplici, tenui, undulato, expansiusculo, subreflexo, superne leviter marginato.*

" Operc. ——

" Diam. major 4, minor 3, axis 4, long. 5 mm.

" Habitat in valle Rungun."

" This is one of the most elevated in the spire among the known Himalayan *Alycæi*. The specimens sent are all weathered, but present no evidence of any considerable sculpture or colouring. The very short sutural tube is a character shared by *otiphorus* and *constrictus* ; and altogether the shell is deficient in prominent features, although perfectly distinct from any of its allies, especially in its aperture (sinuous, and at its upper angle emarginate), its wider umbilicus, plainer sculpture, and more compressed whorls."

I have it from Damsang, Daling District, No. 2504 B.M.

Alycæus (Cycloryx) constrictus, Bs. (Plate CXLVII. figs. 4, 4 *a*.)

Benson (*Cyclostoma*), A. M. N. H. ser. 2, vol. viii. (1851) p. 188.

Pfr. Mon. Pneum. vol. ii. p. 35.

Küster ed. Chemn. (*Cyclostoma*) pl. xlix. figs. 24, 25.

W. T. Blf. A. M. N. H. June 1864, p. 458 (section ii. type species) ; H. & T. Conch. Ind. 1876, p. 39, pl. xcv. figs. 1–4 ; Nevill, Hand-l. i. 1878, p. 294 ; Theobald, Cat. L. & F. W. Moll. B. I. 1876, p. 39.

Original description :—" *Testa perforata, ovato-conica, glabra, costis angustis obliquis distantibus munita, translucente, albida vel rufula ; spira elongato-conica, apice obtuso, sutura valde impressa ; anfractibus 4 rotundatis, superioribus glabris, sequentibus remote costulatis, ultimo mox confertissime costulato-striata, pone aperturam strangulato, anticeque late constricto ; apertura circulari, verticali, $\frac{3}{8}$ longitudinis æquante, peristomate undique reflexo ; operculo testaceo, multispirato sutura inconspicua.*

" Diam. 2, alt. $3\frac{1}{2}$ mill.

" *Hab.* ad Darjiling Himalayæ Sikkimensis.

" This shell has apparently an affinity with the Philippine *C. minus* of Sowerby, but differs in its more tapering form, smaller size, perforation, diverse sculpture, and in the strangulation of the last whorl behind the aperture, in which feature it exhibits an approach to the more shortened *C. gibbum*, Fér., from Turon in Cochin China, and to the depressed *C. strangulatum*, Hutton, so abundant in the more western portion of the Himalaya."

In A. M. N. H. Oct. 1852, vol. x. p. 271, this species is referred to again by Mr. Benson :—

"Another specimen of this shell from Darjiling confirms an additional character for this species, tending still further to show its relation to the more westerly Himalayan species *C. strangulatus*, which was alluded to in my former remarks. The following character should be added:—Callo suturali retroverso, pone constrictionem posito (ut in *C. strangulato*)."

ALYCÆUS CONSTRICTUS, var. MINOR, Bs., A. M. N. H. ser. 3, vol. iii. (March 1859) p. 181.

"I find in the collection four specimens of a small variety of this shell, bleached, but otherwise agreeing with the specimen which I noticed in the 'Annals' for Oct. 1852, when recording the additional character for the genus afforded by the presence of the sutural tube. I can find no other feature to distinguish it from the type than the more flatly expanded and distinctly doubled peristome, in addition to the smaller size. As yet only a single specimen of the larger type is known; it is in a fresh state, but slightly mutilated, and the colour is paler than in my specimen of the smaller type. The latter is deficient in the distant ribs, but they are plainly visible on more than one of Mr. Blanford's weathered examples. A fuller comparison of a series of fresh specimens of the two forms will be required to decide on their claim to separation."

This, I think, can now be done, for among the *Alycæi* in the collection of the Indian Museum, Calcutta, so kindly sent me for study by Dr. N. Annandale, is a tube labelled by G. Nevill: "*Alycæus constrictus* var. *minor*, Darjiling." It is referred to at foot of p. 294 of the Hand-list he left to me, No. 54, as var. *minor*, Benson, Ann. Mag. 1859, and received from Colonel Mainwaring. I cannot concur with Nevill's determination, after comparing these specimens, some 16, with Blanford's type shells, five in number, which vary in size (I have figured the largest), and all are very much bleached and worn, whereas these collected by Mainwaring are very fresh with the sculpture well shown. Mr. Benson's original descriptions were drawn up from this scanty inferior material, and there is no reason why a variety should be constituted.

ALYCÆUS (CYCLORYX) CONSTRICTUS, Bs. (Plate CLIV. figs. 1, 1 *a*.) Specimen figured is in Indian Museum.

*Locality.* Darjiling (B.M. 5528–44) (Colonel G. B. Mainwaring).

Shell: perforation small, conical, rather tumid, transparent; sculpture regular, sharply raised rather distant costulation on the upper whorls, on the length of the sutural tube there are 15 very fine close costate lines; colour pale ochreous; spire moderately high; suture impressed, the sutural tube very short, not club-like; whorls 4, very rounded; aperture circular, vertical; peristome double, but not thickened; operculum pale horny, of few whorls.

Size: maj. diam. 2·8; alt. axis 2·7 mm.

The typical specimen in the Blanford collection and the one I have figured on Plate CXLVII. figs. 4, 4 *a* is somewhat higher in the spire than this one. The surface of the first is so bleached that the costulation can only be seen by close examination with a high power, but it agrees in every way with that of this fresh specimen.

*A. constrictus*, Bs. has been sent from Damsang-Daling District, No. 2505 B.M.

ALYCÆUS (CYCLORYX) OTIPHORUS, Bs. (Plate CXLVII. figs. 2, 2 *a*, 2 *b*.)

Specimen figured, No. 2565 B.M., was compared with the typical specimen in the Cambridge Museum.

A. M. N. H. ser. 3, vol. iii. (1859) p. 178.

Pfr. Mon. Pneum. vol. iii. p. 46.

H. & T. Conch. Ind. p. 39 (1876) pl. xcv. figs. 5, 6; Nevill, Hand-l. i. 1878, p. 292 (*Locality.* Khasi Hills, Naga Hills, Arakan Hills, Pegu & Shan States. All very doubtful localities); Theobald, Cat. L. & F. W. Moll. B. I. 1876, p. 40; Godwin-Austen, *otiphorus*, Bs. var., J. A. S. B. vol. xl. (1871) p. 93, pl. v. figs. 6 *a*, 6 *b*; W. T. Blf., A. M. N. H. 1864, p. 458, section ii.

*Alycæus otiphorus*, Bs. var., J. A. S. B. vol. xl. (1871) p. 93, pl. v. figs. 6 *a*, 6 *b*, see *A. mangutensis*, No. 5.

Original description:—"*Testa perforata, ovato-globosa, minutissime confertim striata, cinereo-cornea; spira conica, apice obtusiusculo, rutilo, sutura valde impressa; anfractibus 4 convexis, ultimo ventricoso, ab apertura subremote constricto, tum pone labrum tumidiusculo, lævigato. tubulum brevissimum suturalem gerente; apertura vix obliqua, peristomate duplici, interno continuo, expanso, interdum breviter porrecto, externo dilatato, reflexo, ad umbilicum processu auriculari brevi, subito reflexo, perforationem subtegente munito. Operculo normali, concaviusculo, planato.*

"Long. $4\frac{1}{2}$, diam. obliq. 4 mill.

"Habitat ad Pankabari (1000 ped. alt.) et in valle Rungun (4000 ped.) prope Darjiling Himalayanum.

"This shell, which seems to be not uncommon on the west side of the Rungun Valley, as well as at a lower elevation in the Sikhim Ranges, was forwarded to me by Mr. H. Blanford in 1857. In form it approaches *A. amphora* and *constrictus*, and, like the latter, which belongs to the same type in the mode of constriction, it is remarkable for the shortness of the sutural tube, but is at once distinguished by the process of the peristome at the umbilicus."

ALYCÆUS (CYCLORYX) SUMMUS, n. sp. (Plate CXLVII. figs. 3, 3 *a*.)

*Locality.* Rechila Peak, Western Bhutan. No. 2573 B.M.

Shell globosely conoid, perforation quite hidden; sculpture fine and rather close costulation, 7 to 8 very fine adjacent to the sutural tube, which is short and pointed, not knob-like; colour

pale with an ochraceous tint; spire high, conic, apex blunt, suture impressed; whorls $4\frac{1}{2}$, the constriction slight, nearly straight up to the reflected peristome and slightly rising; aperture circular; peristome simple strong, double, outer well reflected; operculum smooth, pale horny.

Size: maj. diam. 2·9; alt. 2·9 mm.

This is quite distinct from *A. bembex*, which I at first thought it to be, but the umbilical region differs much. I have some 10 specimens from this high peak, collected by Mr. Wm. Robert.

### 2 *a*. *Eastern Bhutan*.

Up to the Barowli River.

I came across two interesting *Alycæi* in the Beddome Collection recorded from Bhutan, which is not definite enough, for the frontier of that great country extends for over 200 miles along the base of the Eastern Himalaya. It is a pity the precise locality was not given, nor the collector, so often a good clue. I am under the impression the late Mr. Muspratt of the Assam Police collected these shells for Beddome, and from an uncle of his, Dr. Muspratt of Bournemouth, I hear he was at one time in Durrang at Tezpur, but not farther to the westward. This has been confirmed by Mr. E. C. Stuart Baker, now Secretary, British Ornithologists' Union, who for many years served in Assam in the Police, and is well known for his ornithological researches there, particularly in the mountainous parts of the Naga Hills. He tells me Muspratt was at Tezpur, never farther to the westward, and could not therefore have collected at the base of the Bhutan Hills proper, which begin at Dewangiri. Muspratt collected successfully also in the Naga Hills 50 miles east of Kohima, in the Anghami Naga Hills.

Alycæus bhutanensis, n. sp. (Plate CXLVIII. fig. 8.) No. 290, Bedd. Coll. B.M.

*Locality*. Bhutan Frontier, probably on Eastern, or Aka Hills, side.

*Burti*, var. *major*, Bedd. MSS. on label, 2 specimens.

Shell depressedly globose; sculpture extremely fine longitudinal liration crossed by fine close costulation, on the upper whorls, close and much stronger next the sutural tube; colour pale horny; spire low, apex small, suture impressed; whorls 4, the last much swollen on the long sutural tube, constriction hardly to be seen, distance from tube to aperture very short; aperture rather broadly oval, curved on the columellar margin, 3 shallow notches, and 3 subvertical-elongate teeth; peristome double, evenly reflected, strong.

Size: maj. diam. 7·1; alt. 3·9 mm.

The sculpture is very peculiar, and beyond the crenulated peristome it has no similarity with *A. birti*. It is a fine interesting species.

Alycæus commutatus, n. sp. (Plate CXLVIII. fig. 7.)

*Locality.* Bhutan (*ex* Beddome Collection, No. 293).

Shell solid, globosely conoid, openly umbilicate; sculpture rather distant, fine costulation on the upper whorls, becoming much stronger at the sutural tube, quite strong at its base; colour dull white; spire moderately high, apex small; suture impressed, the sutural tube long and strongly formed; whorls 4, well rounded; aperture circular, subangulate above, with 3 sharp folds on the lower outer margin; peristome double, thickened, with columellar margin rounded subvertically; operculum white, shelly, multispiral.

Size: maj. diam. 4·8; alt. axis 2·5 mm.

This shell Colonel Beddome had named *A. burtii*, but it is a far larger, more solid conical shell with the peristome differently crenulated, the operculum being similar.

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## 3. *The Dafla Hills.*

Long. 93° to 94°.

| | |
|---|---|
| *Alycæus akhaensis*, G.-A., n. sp. | Pl. CXLI. figs. 1, 1 *a*, 1 *b*. |
| *barowliensis*, G.-A., n. sp. | Pl. CXLI. fig. 4. |
| *burroiensis*, G.-A., n. sp. | Pl. CXLI. figs. 6, 6 *a*. |
| *burtii*, G.-A. | Pl. CXLIV. figs. 8, 8 *a*. |
| *burtii*, var. *yetayensis*, G.-A. | Pl. CXLIX. fig. 7. |
| (*Cycloryx*) *costatus*, n. sp. | Pl. CLIV. figs. 2, 2 *a*. |
| *daflaensis*, G.-A. | Pl. CXLV. figs. 11, 11 *a*, 11 *b*. |
| *daflaensis*, var. *subdigitatus*. | |
| (*Cycloryx*) *dihingensis*, G.-A., var. | Pl. CXLVI. fig. 6. |
| *dikrangensis*, G.-A. | Pl. CXLVIII. figs. 6, 6 *a*. |
| (*Cycloryx*) *elegans*, n. sp. | Pl. CXLVII. fig. 9. |
| *gemma*, n. sp. | Pl. CXLIX. figs. 6, 6 *a*. |
| (*Cycloryx*) *graphicus*, W. Blf., var. | |
| *macgregori*, G.-A., n. sp. | Pl. CXLI. figs. 2, 2 *a*, 2 *b*. |
| *mundulus*, G.-A. | Pl. CXLIX. fig. 8. |
| *mutatus*, G.-A. | Pl. CXLV. figs. 9, 9 *a*. |
| *neglectus*, G.-A. | Pl. CLIV. fig. 5. |
| *notatus*, G.-A. | Pl. XLIII. figs. 2, 2 *a*, 2 *b*.<br>Pl. CXLV. figs. 8–8 *b*. |
| *pachitaensis*, G.-A. | Pl. XLVIII. figs. 5–5 *c*. |
| (*Cycloryx*) *paucicostatus*, n. sp. | Pl. CXLVII. figs. 5, 5 *a*. |
| *rotundatus*, G.-A., n. sp. | Pl. CLIV. fig. 6. |
| *rugosus*, G.-A. | Pl. CXLI. figs. 7, 7 *a*. |
| *toruputuensis*, G.-A., Nev. MS. | Pl. CXLIX. figs. 3, 3 *a*, 3 *b*.<br>Operc. Pl. CXLV. fig. 10. |
| (*Dioryx*) *urnula*, Bs., var. *daflaensis*. | Pl. CLIII. fig. 4. |

### 3. *The Dafla Hills.*

The valley of the Dikrang and its tributaries.

ALYCÆUS AKHAENSIS, n. sp. (Plate CXLI. figs. 1, 1 *a*, 1 *b*.)

*Locality.* Barowli Gorge, Durrang District, Assam, foot of the Akha Hills (Type No. 2683 B.M.).

Shell globosely conical, openly umbilicated; sculpture very fine, close costulation, flattened as it were, the separation indicated by a fine line next the sutural tube, which is short, smooth on anterior part of the last whorl; strong distant costulation succeeds the fine, becoming finer and more indistinct towards the apex; colour umber-brown; spire rather high; apex blunt; suture impressed; whorls 4, well rounded, the last crossed by a ridge in front of the constriction, and by another, less conspicuous, intervening between it and the peristome; peristome double, thickened; columellar margin slightly sinuate, much sinuated on the outer margin, with four indistinct crenulations, one distinct on the lower margin.

Size: maj. diam. 3·0; alt. axis 1·5 mm.

Only a single specimen—but it is fully grown and distinct.

ALYCÆUS BAROWLIENSIS, n. sp. (Plate CXLI. fig. 4.)

*Locality.* Barowli River, Akha Hills, Durrang, Assam. A single specimen (No. 2723 B.M.) (*Godwin-Austen*).

Shell conoid, compact, narrowly umbilicated; sculpture: distant costulation on the upper whorls, very fine and close next the sutural tube, smooth anterior to it up to the peristome; colour bleached; spire high, conical; apex blunt; suture moderately impressed, sutural tube long; whorls 4, constriction slight, distant from aperture, a slight swelling between the two apertures oval, rounded below, subangulate on the lower outer margin, rounded on the columellar side; peristome double and much thickened.

Size: maj. diam. 3·0: alt. axis 2·0 mm.

A very distinct species, not at all like *A. burtii* from the same locality. Westward of this for four degrees of longitude in the Bhutia country we know nothing of the land mollusca.

ALYCÆUS BURTII, G.-A. (Plate CXLIV. figs. 8, 8 *a*.)

Godwin-Austen, J. A. S. B. 1874, xliii. (2) p. 149, pl. iii. figs. 9, 9 *a* (Type No. 2492 B.M.).

*Original description*:—"Shell turbinate, openly umbilicated, thick, pale ochreous; shallow but well marked ribbing on swell of last whorl and finely costulated on the apex. Spire conoid, apex sharp, suture well impressed. Whorls 5, the last moderately swollen, constriction very slight, short, and smooth up to the peristome; sutural tube moderate, rather large at base. Aperture oblique, laterally oval, angular on inner upper margin, with 4 well

marked notches on the outer margin; peristome thickened, double, well reflected, inner lip continuous.

"Major diam. 0·22″, minor diam. 0·19″, alt. 0·15″.

"*Habitat.* Foot of the Bhutan Himalaya, Akha Hills, at the debouchement of the Barowli River, in Durrang, Assam. Collected by Mr. John Burt. This species occurred again in a pill-box with *A. akhaensis.* My friend John Burt, who resided at Paniputer Tea Garden, not far from the gorge of the Barowli, sent me many good shells from that part of the Durrang District. I stayed with him a few days after the Dafla Expedition was over, and in a trip we made together to the foot of the hills he learnt how and where land-shells were to be found."

ALYCÆUS BURTII, G.-A.

J. A. S. B. xlv. (1876) p. 176.

"*Hab.* This shell, of which I previously possessed a single specimen only, found by Mr. J. Burt in the gorge of the Barowli River, a short distance to the west, proved to be abundant on the outer sandstone range about Dihiri Parbat (No. 2534 B.M.), the Burroi Gorge, &c.

"A variety of it, differing slightly, which is much larger and more depressed in form, but which in the crenate peristome and in form of constriction is the same, occurred in the valley of the Dikrang and in the Yetay ravine. This variety measures in alt. 0·18, major diam. 0·25 in."

ALYCÆUS BURTII, G.-A., var. YETAYENSIS. (Plate CXLIX. fig. 7.) No. 2535 B.M.

*Locality.* Yetay Ravine, No. 24 Peak, Dafla Hills, five specimens (*Godwin-Austen*).

Shell depressedly and globosely conoid, very openly umbilicated; sculpture, costulation fine, somewhat irregular and distant as it approaches the termination of the sutural tube, it is then strong and close. Behind the aperture it is quite smooth. Distinct longitudinal striæ are to be seen on the upper whorls; colour dull pale ochraceous; spire low, apex small, papillate; suture much impressed; whorls $4\frac{1}{2}$, the last swollen, smooth portion behind aperture short with no ridges; aperture circular, slightly angulate above near suture; peristome crenulated on the outer margin, four depressions with strongly defined intermediate processes, straight above, well rounded on the columellar side; operculum multispiral, very concave, and outer margin turned inwards.

Size: maj. diam. 0·75; alt. axis 0·3 mm. Size of largest: maj. diam. 0·9; alt. axis 3·5 mm.

Between the conical globose form of *A. dikrangensis* and the more pyramidal *A. burtii*, there are several such as this which differ considerably in their general shape and are something more than varieties; from the conchological point of view they present excellent

examples of local variation and illustrate, even in a limited area. what changes of elevation and geological conditions can produce, Thus *A. burtii*, type, from the Tertiary Sandstone of the Barowli Gorge, comes nearest to what I took on Dihirhi Purbet, on the same formation and on the outer base of the mountains 60 miles farther east, and may be called *burtii*, var. *A. dikrangensis* was taken on the granite of the main mountain range, some distance from the plains and at some 4000–5000 feet.

ALYCÆUS BURROIENSIS, n. sp. (Plate CXLI. figs. 6, 6 *a*.)

*Locality*. Burroi Gorge, Dafla Hills (Type No. 2653 B.M.) (*Godwin-Austen*).

Shell globosely conical, umbilication narrow; sculpture next sutural tube, fine close costulation, stronger and distant on rest of the whorls, not defined on the apical; colour bleached; spire low; suture impressed, the tube short; whorls 4, the last between sutural tube and aperture crossed by two ridges, the anterior being small and indistinct; aperture quadrate, oblique; peristome double, narrow, roundly angulate on outer margin, canaliculate below; columellar margin nearly vertical.

Size: maj. diam. 2·6; alt. axis 1·75 mm.

A globose form with a curious angulate aperture.

ALYCÆUS DAFLAENSIS, G.-A. (Plate CXLV. figs. 11, 11 *a*, 11 *b*.)

Godwin-Austen, J. A. S. B. 1876, xlv. pt. 2, pp. 176–7, pl. vii. figs. 12, 12 *a*, 12 *b* (Type No. 2497 B.M.).

G. Nevill, Hand-list, i. 1878, p. 291.

*Original description*:—"Shell turbinate, moderately umbilicated, pale whitish or dull ochreous according to the state of the epidermis, finely ribbed throughout, rather more coarsely near the commencement of the swell of the last whorl; on this portion the ribbing is very fine and close. Spire conoid, apex blunt, suture impressed, the sutural tube moderate. Whorls 4, the last swollen, then constricted, and enlarging again into a well-raised ridge, which terminates below on margin of the peristome, it then descends and expands considerably with four deep longitudinal plications. Peristome single (no sign of the usual outer margin), continuous, with five plications on the outer margin, the lower margin recurved. Aperture oblique. Operculum multispiral, horny, with a large disc-like boss in the centre front side.

"*Hab.* Torúpútú Peak, 7000 feet.

"The nearest to the above is *A. digitalis*, H. Blf., described and figured in J. A. S. B. vol. xi. 1871, from Darjeeling, but the duplicate peristome in that shell is conspicuous, and forms a well-defined sharp edge where the expansion and plication of the inner lip commences. By the operculum alone it can be at once distinguished, and it is besides a much smaller shell.

"A dwarf variety [var. *nana*, G.-A.] occurs on Shengorh Peak [No. 2499 B.M.], only 0·09 in. alt., not so expanded near the aperture, and with the plication less developed. On the Tánir ridge, at 4000 feet, the same shell, of ordinary size and with the same character of the aperture, occurs, showing an interesting and gradual change in form; the operculum is also different, being pale coloured, multispiral, and flatly concave in front.

"This form is in this respect much nearer to *A. digitatus*, and might be separated under the title var. *subdigitatus*." (No. 2498 B.M.)

It is a mere variety, differing in its smaller size, more depressed and rounded spire, and finer costulation.

*A. daflaensis* may also be known from the Darjiling *digitatus* by the much coarser and more distant costulation of the latter.

On the Niosi Ridge, Dafla Hills, the specimens taken (No. 2500 B.M.) differ slightly from the type.

ALYCÆUS DIKRANGENSIS, n. sp. (Plate CXLVIII. figs. 6, 6 *a*.)

*Locality.* Toruputu Peak, Dafla Hills (Type No. 2533 B.M.) (*Godwin-Austen*).

Shell somewhat depressedly turbinate, openly umbilicated, the costulation next sutural tube is very fine and close; sculpture becoming coarser but still close towards the apex; colour stony-white; spire pyramidal, apex small; suture impressed, tube long; whorls $4\frac{1}{2}$, regularly increasing, constriction between peristome and sutural tube short; aperture irregularly circular, nearly vertical; peristome double, inner crenulated, five deep notches, the outer continuous, sharply turned back.

Size: maj. diam. 6·0; alt. axis 3·3 mm.

This species might be easily mistaken for *A. lohitensis*, the peristome being very similar, particularly when viewed from the side, but the costulation is very different, as also the crenulation on the side of the aperture. It is also very close to *A. crenulatus* of the Darjiling Hills.

ALYCÆUS GEMMA, n. sp. (Plate CXLIX. figs. 6, 6 *a*.)

*Locality.* No. 7 Camp, Dikrang Valley, Dafla Hills (Type No. 2601 B.M.) (*Godwin-Austen*).

Shell umbilicated, depressedly conoid; sculpture: none on the upper whorls, a few indistinct, fine, costate ribs at suture; colour white; spire low, conoid, apex blunt; suture moderately impressed, the sutural tube short; whorls 4, well rounded, the constricted area is crossed by two ridges, the posterior broad, the anterior narrow and more conspicuous; aperture circular, angulate on upper margin; peristome double, angulate on lower margin, the outer very slightly reflected.

One specimen from this locality only differs in being more solid, and has distant costulation on half the 1st whorl.

Size: maj. diam. 2 8; alt. axis 1·4 mm.

Only three specimens were found. The form recalls that of *A. gemmula*, Bs., of Darjiling, but has distinctive characters by which it may be readily known. Blanford only obtained a single specimen of *A. gemmula*, and Benson recorded it as very rare. Nevill records only two specimens in the Indian Museum. I have since obtained quite a large number from the hills east of the Teesta River.

Alycæus khasiacus, G.-A.

Godwin-Austen, J. A. S. B. 1876, vol. xlv. pt. 2, p. 175 = *mutatus*, G.-A.

"*Hab.* One specimen of the true typical form was found in the Yétay ravine, Dikrang Dhún." Closer comparison shows that I came to a hasty conclusion; this Dafla shell is more globose in form, and differs particularly in the spire, which is higher. No. 2652 B.M.

Alycæus khasiacus, var. Dafla.

"The rest of this type from other parts of the hills, however, differ from the Khasi form in the ridge in front of the constriction being single. and the peristome more thickened and reflected. But in size, sculpture, and the short thickened sutural tube, as well as in the operculum, no change is to be detected."

"*Hab.* Valley of the Dikrang and Borpani."

This is also *A. mutatus* described further on.

Alycæus macgregori, n. sp. (Plate CXLI. figs. 2, 2*a*, 2*b*.) Type No. 2621 B.M. Coll.

G. Nevill, Hand-l. i. p. 292, No. 25.

*Alycæus* var. *nagaenis*, G.-A., 2 Shengorh, Dafla Hills, Coll. Major Godwin-Austen.

*Locality.* Dafla Hills.

Shell openly umbilicate, globosely turbinate; sculpture close, fine regular costulation on the swollen portion of the last whorl following the sutural tube, it contracts behind this and the ribbing becomes much finer and wider apart; colour bleached; spire depressedly conoid, apex small; suture well-impressed; sutural tube moderately long; whorls 4, the first from aperture to sutural tube short, plain, *i.e.*, with no ribbing, then much swollen and contracted again showing well on under sides; aperture circular, oblique; peristome moderately thickened, slightly reflected, within it is feebly plicate; columellar margin rounded.

Size: maj. diam. 7·0, min. 5·5; alt. axis 2·5 mm.

At a hasty glance I had named this shell *A. nagaensis.* On a closer examination and comparison with that species it differs very materially, being much more globose as regards its form, and having crenulation within the aperture. I name this species after Capt.

Macgregor, the officer who commanded the escort to my Survey Party on the expedition into the Dafla country.

The two shells mentioned above have been sent me for determination from the Indian Museum, and prove to be the same as the single type-specimen in my collection, They are far finer, better grown specimens, with crenulated outer lower margin, showing well, with three well-marked folds only just indicated in my drawing. They are also slightly larger, maj. diam. 7·25 mm.

Alycæus mutatus, G.-A. (Plate CXLV. figs. 9, 9 *a*.) Type No. 2495 (Toruputu Peak) B.M.Coll.

*A. mutatus*, G.-A., J. A. S. B. 1876, vol. xlv. pt. 2, p. 177, pl. vii. figs. 11, 11 *a*.

*Original descripton*:—"Shell sub-turbinately depressed, openly umbilicated, fragile, covered with a scabrous dull ochreous epidermis, which peels off in old shells, very regularly and strongly striated throughout, the ribbing on the last whorl very fine. Spire subconoid, apex rather blunt, suture deeply impressed. Whorls 4, rounded, the last swollen, moderately constricted, then again expanded and crossed by two ridges, the last of these not extending all round the whorl. The constriction very regularly ribbed. Sutural tube short, thickened at the base. Aperture oblique, circular. Peristome double but closely united, very slightly reflected. Operculum multispiral, the edges of the outer whorls in high relief so as to form a deep cup-like hollow in the centre.

"Alt. 0·10, major diam. 0·20, sutural tube 0·055 in.

"*Hab.* On Torúpútú, Táuir, and Shengohr Peaks, and the Yétay Ravine, Dikrang Valley (No. 2652 B.M. Coll.) at 6–7000 feet elevation; in the dead leaves and moss about the roots of the forest trees I found about a dozen. The ground at the time was covered with snow, so that it was very cold work hunting for them.

"This shell is an interesting ally of *A. khasiacus*, from which it differs in its thick, well-ribbed epidermis, but more especially in the very different form of the operculum, which in *khasiacus* is quite smooth and concave in front. It is also a smaller and more delicately formed shell."

I have a specimen from the Yétay Ravine, No. 2652, figured in Plate CLVII. fig. 8 for comparison with a species from the Abor Hills, which is far larger but has the double ridge behind the aperture.

Alycæus mundulus, n. sp. (Plate CXLIX. fig. 8.) Type No. 955 B.M.

*Locality.* Torúpútú, Dafla Hills (*Godwin-Austen*).

Shell globosely conoid, umbilicated; sculpture rather strong, regular costulation on the upper whorls, conspicuous, as next the suture it is peculiarly fine and regular; colour white; spire high, about half the diameter, apex fine; suture impressed, the sutural tube moderately long; whorls 4, well rounded, constriction slight

and scarcely any swelling; aperture oblique, ovate, the upper outer margin protruded forwards, behind the aperture; peristome simple, double, rounded below, angulate near suture, nearly vertical on the columellar side.

Size: maj. diam. 4·5; alt. axis 2·25 mm.

This shell I found in the Blanford collection, it came from me; two had been sent, one was missing; it was labelled *theobaldi*, var. In form it is curiously like *A. commutatus* an allied subspecies, as well as in the type of sculpture and the operculum, but the aperture is quite distinct.

Alycæus neglectus, n. sp. (Plate CLIV. fig. 5.) Type No. 2494 B.M.

*Locality.* Torúpútú Peak, Dafla Hills, two specimens (*Godwin-Austen*).

Shell globosely pyramidal, openly umbilicated, remains of a dark epidermis; sculpture on upper whorls, fine, irregular, rather close, raised striæ, becoming finely costulate for the length of the sutural tube: colour whitish, probably pale brown when younger; spire fairly high, apex small; suture impressed, the tube moderately long; whorls 4, well rounded, the last slightly constricted then swelling into a straight ridge halfway between the costulate portion and the aperture; aperture oval, oblique; peristome simple, straight, yet curving slightly on the columellar side, rather flat below, curving up on the outer margin; operculum black, smooth.

Size: maj. diam. 5·25; alt. axis 30 mm.

In form quite distinct from *A. theobaldi* of the Khasi Hills.

Alycæus notatus, G.-A. (Plate CXLV. figs. 8, 8 *a*.) Type No. 2672 B.M.

Godwin-Austen, J. A. S. B. 1876, vol. xlv. pt. 2, p. 176, pl. vii. figs. 9, 9 *a*, 9 *b*; Moll. Ind. 1886, vol. i. pt. v. p. 191, pl. xliii. figs. 2, 2 *a*, 2 *b*.

*Original description.*—"Shell globosely turbinate, narrowly umbilicated, of solid form, white; distant strong costulation on the upper whorls, close and fine ribbing on swollen portion of the last. Spire conoid, suture fairly impressed. Whorls 4½, closely wound, the last swollen, then sharply constricted, and again enlarged and descending, the expanded portion being marked with deep fold-like furrows. Sutural tube moderate, aperture oblique. Peristome very thick, distinctly treble in full-grown shells, outer layer terminating just behind the aperture, the inner continuous, the two outer much reflected near the umbilicus. Operculum smooth in front.

"Alt. 0·14, maj. diam. 0·17 in.

"*Hab.* On the slopes of Torúpútú Peak at 3000 feet, about 15 specimens collected.

"This is one of the most distinct and curious species I have yet discovered, the fold-like indentations upon the expanded portion

near the aperture having no counterpart in any other form with which I am acquainted. In other respects it is somewhat similar to *A. diagonius*, in the strong thick peristome and closely-wound whorls."

ALYCÆUS PACHITAENSIS, G.-A. (No. 2614 B.M. Type.)

Land & Freshw. Moll. Ind. vol. i. pt. v. (1886) p. 190, pl. xlviii. figs. 5–5 *c*.

ALYCÆUS ROTUNDATUS, n. sp. No. 2543 B.M. Type. (Plate CLIV. fig. 6.)

*Locality*. Dafla Hills.

Shell well umbilicated, globosely conoid, with a strong epidermis; sculpture indistinct and somewhat irregular, fine costulation on upper whorls, close and fine on the swollen portion near the rather long sutural tube; colour umber-brown; spire moderately high, apex fine; suture impressed; whorls 4, rounded, between the sutural tube and the aperture there is a slight swelling, this part quite smooth; aperture irregularly oval, slightly angulate above; peristome simple, double, somewhat thickened on lower margin, curved on the columellar side, slightly reflected.

Size: maj. diam. 4·8; alt. axis 2·2 mm.

The shell is very similar to *A. sylheticus*.

ALYCÆUS RUGOSUS, n. sp. No. 2641 B.M. Type. (Plate CXLI. figs. 7, 7 *a*.)

*Locality*. Burroi Gorge, Dafla Hills (*Godwin-Austen*).

Shell globosely conical, umbilicus much constricted; sculpture, well defined, close costulation next the suture, becoming for a short distance behind finer and then at once becoming strong and distant on the upper whorls; colour whitish; spire high, conical; suture well-impressed, the sutural tube not very long; whorls 5, well rounded, the last crossed by a single strong ridge between the constriction and the aperture; aperture angularly oval, oblique; peristome much crenulated, on the outer and lower margins double; columellar margin suboblique, curving.

Size: maj. diam. 3·0; alt axis 1·8 mm.

I have compared this species with *Alycæus crispatus* from the Western Khasi, Garo Frontier, and with *crispatus*, var. from the Diyung Valley near Asalu (*vide* plate iv. figs. 1 & 2, J. A. S. B. vol. xl. 1871), and although a close ally, it differs considerably from both, being much more conical, and with a different constricted area.

ALYCÆUS TORUPUTUENSIS, G.-A. Nevill MS.

*Alycæus theobaldi*, W. T. Blanford, Jour. Asiat. Soc. Bengal, 1876, vol. xlv. pt. 2, p. 175, pl. vii. fig. 10 (operculum).

*Alycæus theobaldi*, W. T. Blanford, var., Nevill, Hand-l. no. 4, p. 290, Dafla Hills (Major H. H. Godwin-Austen).

The specimen figured is this type-shell. Typical specimens No. 2496 are in the Natural History Museum. It was thus described:—

"Is of the same form as *A. theobaldi* from Cherra Poonjee and the Garo Hills, only that while the operculum in the latter is exceedingly closely wound, quite smooth in front, and black (and I have examined some dozens of shells), in the former the concentric whorls are wider apart, have a central circular hollow space and are white. The ribbing of the swollen portion in the Dafla shell is exceedingly fine, and this, I note, is a common character, holding good almost without exception, of all the species in the Dafla Hills."

There is also a striking difference in the contraction of the whorl near the umbilicus.

It was found on the slopes of Torúpútú Peak in the Dafla Hills.

Alycæus toruputuensis, G.-A. (Plate CXLIX. figs. 3, 3 *a*, 3 *b*; Operculum, Plate CXLV. fig. 10.)

Type in Indian Museum, Calcutta.

Alycæus (Dioryx) urnula, Bs., var. daflaensis. (Plate CLIII. fig. 4.)

Godwin-Austen, J. A. S. B. 1876, xlv. pt. 2, p. 178.

*Locality.* Dafla Hills, Niosi Ridge and Toruputu Peak. From first locality, No. 2600, figured.

*Original description*:—"Higher in the spire, aperture proportionally larger; whorls *more rounded, sutural tube only one-fourth the length,* and the ribbing much less fine on the swell of the whorl—differences which by some would be considered quite sufficient to warrant another name being given to this Dafla form. Five specimens were found, all possessing the above character, so it would appear to be quite constant."

Alycæus (Cycloryx) costatus, n. sp. (Plate CLIV. figs. 2, 2 *a*.)

Type No. 2596 B.M.

*Locality.* Dikrang Valley, Dafla Hills (*Godwin-Austen*).

Shell narrowly perforate, elongately conical; sculpture distant, well-raised costulation. continuous up to the aperture, about 7 costæ anterior to the short sutural tube; colour stony-white, apex yellowy pink fading to ochraceous; spire high, sides flat, apex rather pointed; suture impressed; whorls 4, well rounded; aperture circular, vertical; peristome double, reflected.

Size: maj. diam. 2·75; alt. axis 2·0 mm.

Quite a large number of this species was found, seventeen in all; it is a close ally of *A.* (*Cycloryx*) *paucicostatus*, but is more elongate, spire not so pyramidal, and it is a smaller shell. It approaches

specimens Nos. 5528–44 received from the Indian Museum, Calcutta, as *constrictus*, var., but I consider them true *constrictus*, see figs. 4, 4 *a*, Plate CXLVII. This Dafla shell is of a different, more elongate shape, although the umbilical region is similar and perforate.

ALYCÆUS (CYCLORYX) ELEGANS, n. sp. (Plate CXLVII. fig. 9.)

*Locality.* Shengorh Peak, Dafla Hills, No. 2594 B.M. (*Godwin-Austen*).

Shell elongately turbinate, perforate; sculpture very fine, close, regular costulation; colour whitish with a burnt sienna tint; spire high, apex blunt; suture impressed; whorls 4½, sides very convex; aperture circular; peristome double, not thickened, with a flange hiding the umbilicus.

Size: maj. diam. 2·6; alt. axis 2·0 mm.

ALYCÆUS (CYCLORYX) GRAPHICUS, W. Blf., var. No. 2598 B.M.

*Locality.* Burroi Gorge, foot of the Dafla Hills (*Godwin-Austen*).

Specimens from this locality are very close to those from the Khasi Hills, N. Cachar, etc., but there is variation when they are examined side by side.

A specimen from the Dikrang Valley, No. 2597 B.M., is almost identical with the var. *dihingensis*—from the Dihing valley near Sadia—described further on.

ALYCÆUS PAUCICOSTATUS, n. sp. No. 2595 B.M. Coll. (Plate CXLVII. figs. 5, 5 *a*.)

*Locality.* Torúpútú Peak, Dafla Hills (*Godwin-Austen*).

Shell narrowly perforate, globosely conical, transparent; sculpture close, well-marked, regular costulation, 3 strong costæ behind aperture, one close to it inconspicuous; colour rich pale ochraceous; spire moderately high; suture impressed, 5 costæ on sutural tube; whorls 4, well rounded, constricted close to the club-like tube; aperture circular, nearly vertical; peristome closely double, reflected; operculum ochre in colour, smooth with central depression, evenly spiral.

Size: maj. diam. 3·1; alt. axis 2·3 mm.

This species is much smaller than a closely allied one from same area.

### 3 *a*. *The Miri Hills.*

Including the Valley of the Subansiri and its Tributaries.

Recently explored and surveyed by Captains Morshead and Bailey, R.E., of the Indian Survey—1912–13.

A few species in other genera, but no *Alycæi* as yet received from this area.

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4. *Eastern Assam.*

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|---|---|
| *Alycæus brahma*, G.-A. | Pl. XLVIII. fig. 3. |
| *brahma*, G.-A., var. | |
| *distinctus*, G.-A., var. | Pl. CXXXVII. figs. 2, 2*a*, 2*b*. |
| *Dioryx*) *urnula*, var. *globosus*. | Pl. CLIII. fig. 8. |
| (*Cycloryx*) *granum*, G.-A. | Pl. LXIII. fig. 6. |
| (*Cycloryx*) *graphicus*, var. *dihingensis*, n. sp. | Pl. CXLVI. figs. 6, 6*a*. |
| *lohitensis*, n. sp. | Pl. CXXXVII. figs. 1, 1*a*. |
| *oglei*, n. sp. | Pl. CXLVIII. fig. 2. |

This is a large extent of country, much of it but little known from a natural history point of view. It includes the Eastern Naga Hills from about the longitude of Seebsagur, on to Sadia, and the valleys of the Diyung and Lohit, from Brahmakund eastwards, lying north of the High Snowy Range in which the tributaries of the Irravaddy, the Mali Hka, and N'Mai Hka, take their rise. The terrestrial mollusca from the vicinity of this range cannot fail to be of extreme interest, in the relationship of those of Burma on the one hand, and Assam and the Tsanspu valley on the other.

Alycæus oglei, n. sp. (Plate CXLVIII. fig. 2.) No. 2491 B.M. Coll. Type.

*Locality*. Sadia, one specimen figured; Dihing, 500 ft., type, two specimens (*M. T. Ogle*).

Shell globosely conoid, umbilicated; sculpture, close regular costulation on the swollen part of the last whorl, at termination of the suture becoming more distant; colour bleached; spire high, turbinate, apex small; suture very impressed, the sutural tube very long; whorls 4, with very rounded sides, very slightly constricted at the sutural tube and expanded slightly to the aperture, this portion short and smooth; the aperture subvertical, horizontally oval, slightly angulate on upper inner margin; peristome double, thickened, crenulated, with four indentations, the first high on outer margin. The operculum (Dihing specimen) is remarkable, being multispiral and deeply concave in front.

Size: maj. diam. 5·5; alt. axis 2·9 mm.

The shell figured from Sadia is unfortunately rather an old specimen, the costulation much worn; from the Dihing valley, one is in a perfect stage of growth and shows the type of sculpture well.

Alcyæus lohitensis, n. sp. (Plate CXXXVII. figs. 1, 1*a*.) No. 2493 B.M. Type.

*Locality*. Brahmakund, Eastern Assam (*M. T. Ogle*).

Shell turbinate, umbilicus open; sculpture fine, rather close costulation, close, coarser and well defined near the sutural tube, which is long; colour stony white; spire rather high, apex fine;

suture slightly impressed; whorls $4\frac{1}{2}$, the three apical small; aperture circular, slightly angulate on upper margin, with four distinct crenulations below; peristome double, thickened, not expanded, crenulation only slightly shown on outside, the inner sharply folded back; columellar margin rounded; operculum smooth, black.

Size: maj. diam. 4·5; alt. axis 3·5 mm.

This may be compared with the Dafla Hill species *A. burtii* and *A. rugosus*, but the form of the aperture differs considerably.

ALYCÆUS BRAHMA, G.-A. No. 2610 B.M.

Moll. Ind. Vol. I. pt. v. (1884) p. 195, pl. xlviii. fig. 3.

A variety of this species was also found by Mr. Ogle in the Dihing valley, Singpho Hills, No. 2611 B.M.

ALYCÆUS DISTINCTUS, G.-A., var. (Plate CXXXVII. figs. 2, 2 *a*, 2 *b*.)

*Locality.* Sadia, No. 2620 B.M. (*M. Ogle*).

This shell differs from the typical form in the Western Naga Hills in its flatter depressed shape, rounded aperture, and the shorter distance from it to the sutural tube. It was also found in the Dihing valley at 500 ft. (M. Ogle). No. 2626 B.M.

ALYCÆUS (DIORYX) URNULA, Bs., var. GLOBOSUS. (Plate CLIII. fig. 8.) No. 2532 B.M. Coll.

*Locality.* Brahmakund, E. Assam (*M. T. Ogle*).

Shell globosely and depressedly conical, scarcely perforate; sculpture, extremely fine costulation next the sutural tube and still farther back, the upper whorls smooth; colour pale whitish brown; spire depressed, apex blunt; suture moderately impressed; sutural tube moderately long; whorls 4, tumid, constricted close behind the peristome, distance of this last to base of sutural tube very short; aperture circular; peristome double, much thickened, sharply and shortly reflected; operculum distantly spiral, central whorl conspicuous, colour dull yellow.

Size: maj. diam. 4·0; alt. axis 3·75 mm.

ALYCÆUS (CYCLORYX) GRAPHICUS, var. DIHINGENSIS. (Plate CXLVI. figs. 6, 6 *a*.) No. 2516 B.M.

*Locality.* Sadia, Assam, 350 ft. (*M. Ogle*).

Shell: umbilicus covered by expansion of outer lip, tumidly conical; sculpture above somewhat distant regular costulation, there are 4 costæ next the sutural tube, 3 distant well developed behind the aperture, in another specimen two only; colour very pale ochraceous; spire high, apex fine; suture impressed, the tube short and oblong; whorls 4, well rounded; aperture circular, subvertical; peristome expanded and slightly reflected, double.

Size: maj. diam. 3·75; alt. axis 3·0 mm.

The specimens from this part of Assam differ slightly from the type, but hardly to an extent to make them distinct species.

ALYCÆUS (CYCLORYX) GRANUM, G.-A.

P. Z. S. 1893, p. 593.
Moll. Ind., Vol. II. pt. vii. Oct. 1897, pl. lxiii. fig. 6.

### 4 *a*. *Abor Hills and Tsanspu Valley.*

| | |
|---|---|
| *Alycæus aborensis*, n. sp. | Pl. CXLIX. fig. 9. |
| *chanjukensis*, n. sp. | Pl. CLVII. figs. 5, 5 *a*. |
| (*Cycloryx*) sp. near *costatus*. | |
| *duoculmen*, n. sp. | Pl. CLVII. figs. 2, 2 *a*. |
| (*Dioryx*) *globulosus*, n. sp. | Pl. CLVII. figs. 1, 1 *a*. |
| *luyorensis*, n. sp. | Pl. CLVII. figs. 6, 6 *a*. |
| *magnificus*, n. sp. | Pl. CLVI. figs. 1, 1 *a*, 1 *b*. |
| *oakesi*, n. sp. | Pl. CLVII. figs. 4, 4 *a*. |
| *panggiana*, n. sp. | Pl. CLVI. figs. 3, 3 *a*. |
| *sibbumensis*, n. sp. | Pl. CLVI. figs. 4, 4 *a*. |
| (*Dioryx*) *urceolus*, n. sp. | Pl. CLIII. figs. 9, 9 *a*. |
| *vesica*, n. sp. | Pl. CXLIX. fig. 10. |
| *yamneyensis*, n. sp. | Pl. CLVI. fig. 2. |

ALYCÆUS ABORENSIS, n. sp. (Plate CXLIX. fig. 9.) No. 3102 B.M. Coll.

*Locality*. Bapu Peak, Abor Hills (*Lt. G. F. T. Oakes, R.E.*).

Shell umbilicated, very globosely conoid, the sutural tube very long, so that the end is visible when the shell is viewed from the front; sculpture: fine costulation on the three apical whorls, with regular very fine longitudinal striation and succeeded by fine transverse striation and very fine close costulation next the suture; colour bleached; spire rather high, apex small; suture impressed; whorls 4, well rounded, the last much swollen, becoming much smaller near the constriction and swelling slightly again towards the aperture; aperture oval, obliquely angulate on upper margin, vertical on inner side, curving; peristome double, the inner sinuately and moderately crenulate on outer lower margin.

Size: maj. diam. 7·75; alt. axis 4 mm.

In the extremely fine costulation of the swollen part of the whorl next the suture, this species approaches *A. omissus* of the Shan States.

ALYCÆUS CHANJUKENSIS, n. sp. (Plate CLVII. figs. 5, 5 *a*.)

*Locality*. Chanjuk La, Tsanspu Valley, 4300 ft., Lat. 29° 25′, Long. 95° 20′, No. 3583 B.M. (*Lt. G. F. T. Oakes, R.E.*).

Shell globosely conoid, closely umbilicated; sculpture: fine

rather close costulation on the apical whorls, strong and close-set next the sutural tube, becoming gradually finer posteriorly; colour bleached; spire high, conical, apex fine; suture impressed, sutural tube very long; whorls 4½, well rounded on the sides, the constriction is short; aperture ovately circular, subvertical; peristome double, deeply and sharply crenulated, 4 deep channels running backwards separated by V-shaped barriers, and much thickened as viewed from the side; columellar margin well curved.

Size: maj. diam. 4·58; alt. axis 2·7 mm.

This may be compared with *A. vesica* from the same great valley, but its spire differs and the crenulation is sharper and finer. It may be also compared with *A. lohitensis* from Brahmakund, but the difference is quite specific. All the specimens are bleached and fragile and evidently picked up on a jungle clearing after the timber was fired.

ALYCÆUS DUOCULMEN, n. sp. (Plate CLVII. figs. 2, 2 *a*.)

*Locality*. Tsanspu Valley, No. 3582 B.M. (*Lt. G. F. T. Oakes, R.E.*).

Shell globose-conoid, somewhat depressed, openly umbilicated; sculpture fine indistinct, costulation on upper whorls showing near the suture, apex smooth, very fine and close near sutural tube; colour whitish grey above, pale ochraceous on the swollen part of the whorl; spire depressedly conoid, apex small; suture impressed, sutural tube rather short; whorls 4, the last much swollen behind the sharp constriction, in front the whorl is crossed by a well-raised ridge, a narrow furrow, and then another ridge, narrowing to a point below; aperture angularly and widely ovate, oblique; peristome double, much thickened, reflected, subangulate above near suture, rounded on the periphery of the whorl, then descending, with indistinct crenulation up to the subvertical columellar margin, which is thickened below; operculum black, placed too far in to see the spiral.

Size: maj. diam. 4·75; alt. axis 2·25 mm.

Only one specimen was found, but that a most perfect one, and very distinct from such double-ridged species as *birugosus*, *multirugosus*, &c., also in the angulate form of the aperture.

ALYCÆUS LUYORENSIS, n. sp. (Plate CLVII. figs. 6, 6 *a*.) No. 3527 B.M.

*Locality*. Luyor, Abor Hills, 7200 ft. (*Lt. G. F. T. Oakes, R.E.*).

Shell globosely turbinate, umbilicated; sculpture, very fine close regular costulation next the suture, very fine on whorls above, hardly seen on apical; colour dull white above, pale ochraceous on the swollen portion of the last whorl; spire moderately high; suture moderately impressed, sutural tube moderately long; whorls 4½, constriction short, no swelling between sutural tube and aperture; aperture circular; peristome double, very slightly

reflected, openly and expandedly crenate; columellar margin curving vertically; operculum slightly concave in front, distantly spiral.

Size: maj. diam. 6·8; alt. axis 4·0 mm.

The form and sculpture distinguishes this shell from the other crenulated species obtained in the valley of the Tsanspu.

### Subgenus Raptomphalus, nov.

Shell globosely conoid, widely umbilicated. The margin of the umbilicus is a well developed keel, which commences near the constriction. The peristome is strongly and irregularly crenulated, showing well behind the aperture viewed from the side, between this and the sharp constriction a well raised ridge crosses the whorl transversely.

Alycæus (Raptomphalus) magnificus, n. sp. (Plate CLVI. figs. 1, 1 *a*, 1 *b*.) No. 3115 B.M. Coll.

*Locality.* Yamne Valley, Abor Hills (*Lt. G. F. T. Oakes, R.E.*).

Shell very openly umbilicated, bordered by a distinct keel, very globosely conoid; sculpture on the upper whorls, and as far as the end of the long sutural tube there is distant strong costulation, thence for the length of the tube it is extremely fine and close; colour white, shell old; spire moderately high, apex small, somewhat depressed; suture impressed; whorls $4\frac{1}{2}$, tumid, the constriction is sudden and close to the base of the sutural tube, it there expands considerably towards the aperture, commencing with a high ridge well raised, and this again by another broader and more rounded, which merges into the very broad expanded wavy peristome; aperture ovate, subangulate both above and below; peristome strongly crenulated, with five indentations.

Size: maj. diam. 4·25; alt. axis 1·7 mm.

This is a very beautiful species. The sharp, well defined keel around the umbilicus is a character quite new to me in this genus, one which has led me to place it in a new subgenus. In the very fine costulation on the swollen portion of the last whorl, it is similar to *A. aborensis.*

Alycæus oakesi, n. sp. (Plate CLVII. figs. 4, 4 *a*.) No. 3578 B.M. Coll.

*Locality.* Chanjuk La, in Tsanspu Valley, 4300 ft., Lat. 29° 25′, Long. 95° 20′ (*Lt. G. F. T. Oakes*). 5 specimens.

Shell very globosely conoid, somewhat depressed, openly umbilicate, with a strong tendency to a ridge bounding it; sculpture, costulation distant, subdued on the apical whorls, strong and coarse near base of the sutural tube, but soon becoming finer; colour, all old and bleached shells; spire moderately high, apex small; suture impressed; whorls 4, much swollen next sutural tube, the last

sharply constricted, enlarging suddenly into a high sharp ridge, across the whorl, flattened in front and expanding to the aperture, which is nearly circular; peristome double, the inner lip thickened, the outer less so, the shelly layers are seen overlapping each other when viewed from the left side.

Size: maj. diam. 3·0; alt. axis 1·3 mm.

This species was found near the furthest point as yet surveyed up the Tsanspu (1913) or about 150 miles up the River from Pasighat.

ALYCÆUS PANGGIANA, n. sp. (Plate CLVI. figs. 3, 3 *a*.) No. 3143 B.M. Coll.

*Locality*. Sibbum, Abor Hills (*Lt. G. F. T. Oakes, R.E.*). Only a single specimen received.

Shell openly umbilicated, globosely conical, sculpture, fine; close costulation next the sutural tube, succeeded by much stronger and more distant, towards the apex becoming very fine: colour whitish; spire moderately high, apex small; suture moderately impressed; whorls 4, well rounded, the last smooth and straight from sutural tube to the aperture; aperture circular; peristome well rounded on the inner margin, well crenulated on the outer in 5 folds; operculum multispiral, sutures distant, intermediate space diagonally striate, with well-marked lines of growth.

Size: maj. diam. 4; alt. axis 1·6 mm.

I name this species after the Abor Clan Panggi, of which the principal stockaded village is Sibbum.

The sutural tube is bent on itself in this particular specimen, and must be abnormal, for although I have now handled hundreds of shells of this genus, I have never seen one like it before.

ALYCÆUS SIBBUMENSIS, n. sp. (Plate CLVI. figs. 4, 4 *a*.) No. 3142 B.M. Coll.

*Locality*. Sibbum, Abor Hills (*Lt. G. F. T. Oakes, R.E.*).

Shell globosely conoid, solid, well umbilicated; sculpture: very fine, close transverse costulation near apex, becoming more distant on the 3rd whorl, extremely fine and close next the long sutural tube; there is an indication of distant longitudinal liration also at this part; a few distant indistinct liræ cross the smooth portion in front of the constriction; colour whitish stone; spire fairly high; suture well impressed; whorls 4, sides well rounded, the last very tumid; aperture nearly circular, subvertical on the columellar side; peristome double, very much thickened on the outer margin, less so on the inner.

Size: maj. diam. 6·7; alt. axis 3·0 mm.

The sculpture, particularly that of the swollen portion of the last whorl, near the sutural tube, is characteristic of several species of *Alycæi* of the Abor Hills.

Alycæus vesica, n. sp. (Plate CXLIX. fig. 10.) No. 3101 B.M.

*Locality.* Bapu Peak, Abor Hills (*Lt. G. F. T. Oakes, R.E.*).

Shell very globosely conoid, with a strong epidermis; sculpture, strong close costulation from the long sutural tube backwards on the swollen portion of the whorl, becoming very fine on the whorls above; colour pale ochraceous brown; spire rather high, apex small and fine; suture impressed; whorls $4\frac{1}{2}$, closely-wound, constriction short, smooth, then swelling much round to the left front of the shell; aperture oval, angulate on upper margin, subvertical; peristome strongly crenulated, with four deep channels, double, thick, vertical and sinuate on the columellar margin.

Size: maj. diam. 6·75; alt. axis 4·0 mm.

Alcyæus yamnayensis, n. sp. (Plate CLVI. fig. 2.) No. 3114 B.M. Coll.

*Locality.* Yamne Valley, Abor Hills (*Lt. G. F. T. Oakes, R.E.*).

Shell umbilicated, very globosely conoid; sculpture above fine. distinct horizontal striæ superimposed by fine regular and distant costulation—fine regular costulation on the swollen part next the sutural tube; spire high, apex small, acute; suture impressed, the sutural tube very long; whorls 5, the last very rounded and swollen; the constriction is sharp, the distance to the aperture short, smooth, and nearly flat; aperture irregularly oval, curving above, nearly vertical on the columellar side; peristome thickened, double and strongly crenulate on the outer margin, with three conspicuous ridges, above these the inner lip is much thickened, the outer lip has a marked expansion on the inner lower margin.

Size of type: maj. diam. 7·25; alt. axis 4·0 mm.
,, largest: ,, 7·75 mm.

This species is of the type of *A. oglei* of the Noa Dihing Valley, south of the Brahmaputra, but is far larger, more globose, with a finer apex and much stronger peristome. *A. aborensis* is also a close ally, but differs in form. slight crenulation, and the very different costulation on the swell of the last whorl.

From Shimang, on the Dihang, Lt. G. F. T. Oakes, R.E., has sent me an *Alycæus*, No. 3144 B.M., very close to *A. yamneyensis*, but smaller. only 6·5 in major diameter; it is represented by seven specimens.

Alycæus (Dioryx) globulosus, n. sp. (Plate CLVII. figs. 1, 1*a*.) No. 3528 B.M.

*Locality.* Luyor, Tsanspu Valley (*Lt. G. F. T. Oakes, R.E.*).

Shell globosely conical, closely perforate; sculpture, a strong epidermis, with irregular transverse striæ of growth and with streaks of brown; spiral striation is indistinctly seen, on swollen portion very regular close flat costulation; colour pale umber-brown; spire low, apex blunt; suture well impressed; whorls 4, tumid, the last reflected just behind the aperture; aperture

circular; peristome double, much thickened, very slightly reflected; operculum widely spiral, the sutures distant, slightly concave.

Size: maj. diam. 3·25; alt. axis 4·0 mm.

The operculum is of the type of *D. urnula*, smooth in front, the sutures only just discernible.

ALYCÆUS (DIORYX) URCEOLUS, n. sp. (Plate CLIII. figs. 9, 9 *a*.) No. 3084 B.M. Coll.

*Locality*. Abor Hills (*Lt. G. F. T. Oakes, R.E.*).

Shell ovately globose, elongate, no perforation; sculpture, costulation next the sutural tube very fine and close, rest of shell finely striate; colour bleached; spire high, apex small; suture impressed, the sutural tube moderately long: in the drawing made from the first specimen received (many more came to hand afterwards) this is represented too short, the end being broken; whorls $4\frac{1}{2}$, sides rounded; constriction short behind aperture; aperture oval vertically; peristome simple, double, rather solid.

Size: maj. diam. 4·8; alt. axis 4·25 mm.

This species differs considerably from typical *urnula* in being far larger and so high in the spire, *urnula* being more globose and depressed; from another Abor species of this subgenus it may be known at once by its less tumid globose shape and the peristome being far less thickened.

ALYCÆUS (CYCLORYX) sp.

*Locality*. Abor Hills, on Tsanspu, No. 3116, Lat. 29° 25′, Long. 95° 20′ (*Oakes*).

A single but not perfect specimen was found among a number of *Dioryx*. It is characterized by strong costulation, and more particularly by the openness of the umbilical region. In these characters it is like *A.* (*Cycloryx*) *costatus* of the Dafla Hills.

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5. *Garo, Khasi and Jaintia Hills* (*on South to S. Sylhet and on North to the Brahmaputra River*).

| | |
|---|---|
| *Alycæus birugosus*, G.-A. | Pl. LXIII. figs. 5, 5 *a*. |
| *birugosus*, G.-A., var. | Pl. CLIV. figs. 7, 7 *a*. |
| *birugosus*, var. *minor*. | Pl. CLV. figs. 9, 9 *a*. |
| *canaliculus*, n. sp. | Pl. CLIV. fig. 11. |
| *crispatus*, G.-A. | Pl. CXLV. figs. 1, 1 *a*, 1 *b*, 7. |
| *crispatus*, var. *minimus*. | Pl. CXLVIII. figs. 5, 5 *a*. |
| *crispatus*, var. *makarsæ*, G.-A. | Pl. CLVIII. fig. 13. |
| *crispatus*, var. *rywukensis*. | Pl. CLIV. figs. 3, 3 *a*. |
| *generosus*, n. sp. | Pl. CXXXVIII. figs. 8, 8 *a*, 8 *b*. |
| (*Cycloryx*) *graphicus*, W. Blf., var. *khasiensis*. See No. 8. | Pl. CXLVI. figs. 2, 2 2 *a*,*b*. |
| *habiangensis*, n. sp. | Pl. CXXXVIII. figs. 2, 2 *a*, 2 *b*. |

| | |
|---|---|
| (*Charax*) *hebes*, Bs. Type of subgenus. | Pl. XLIII. figs. 1–1 *c*.<br>Pl. CXLV. figs. 5, 5 *a*, 5 *b*. |
| *jaintiacus*, G.-A. | Pl. CXLIII. figs. 3, 3 *a*, 3 *b*. |
| *jainitiacus*, var. *crassus*. | Pl. CXXXVII. figs. 5, 5 *a*. |
| *kamakiaensis*, n. sp. | Pl. CXLI. fig. 8. |
| *khasiacus*, G.-A. | Pl. CXLIII. figs. 7, 7 *a*, 7 *b*. |
| (*Cycloryx*) *mangutensis*, n. sp. | Pl. CXLVI. figs. 5, 5 *a*.<br>Pl. CXLIII. figs. 11, 11 *a*. |
| *nongtungensis*, n. sp. | Pl. CXXXVIII. figs. 5, 5 *a*. |
| *obscurus*, n. sp. | Pl. CLIV. figs. 9, 9 *a*. |
| *perplexus*, n. sp. | Pl. CLV. fig. 11. |
| *prosectus*, Bs. | Pl. CXLIII. figs. 1, 1 *a*, 1 *b*. |
| *pusillus*, G.-A. | Pl. CXLIII. figs. 6, 6 *a*, 6 *b*. |
| *strigatus*, G.-A. | Pl. CXLIV. figs. 2, 2 *a*, 2 *b*. |
| *sylheticus*, n. sp. | Pl. CLIV. figs. 4, 4 *a*. |
| *teriaensis*, n. sp. | Pl. CLIV. figs. 10, 10 *a*. |
| *theobaldi*, W. Blf. | Pl. CXLV. figs. 4, 4 *a*, 4 *b*. |
| *theobaldi*, var. *solidus*. | Pl. CLV. fig. 10. |
| (*Dioryx*) *urnula*, Bs., var. *pisum*. | Pl. CLIII. figs. 3, 3 *a*, 7. |

Alycæus birugosus, G.-A. No. 2623 G.-A. Coll. B.M.

Godwin-Austen, Moll. Ind. vol. ii. 1897, p. 2, pl. lxiii. figs. 5, 5 *a*.

*Locality*. Khasi Hills.

The specimen mentioned with the original description from the Burak Valley is nearer to true *A. khasiacus* (Plate CXLIII. fig. 7); it has a circular aperture. I distinguish it as *A. duorugosus*.

Alycæus birugosus, G.-A., var. (Plate CLIV. figs. 7, 7 *a*.) No. 2571 G.-A. Coll. B.M. (shell figured).

*Locality*. Jawai, Jaintia Hills (9 specimens, *Godwin-Austen*).

Shell depressedly globose, rather closely umbilicated: sculpture: none on upper whorls, in fresh shells smooth and shiny, costulation for a short distance next the sutural tube; colour very pale ochraceous; spire rather low, apex blunt; suture impressed, the sutural tube short; whorls $3\frac{1}{2}$, rounded, the last is swollen behind the constriction, which is short, it is then crossed by two distinct ridges which coalesce on the lower side, they fill the space up to the peristome; aperture oval, subangulate above, also below, where there is a canaliculate notch; peristome solid, double, inner reflected.

Size: maj. diam. 2·9; alt. axis 1·3 mm.

This species comes near to *A. khasiacus* in several characters, particularly in the short sutural tube. It is very much smaller, much closer wound, with smaller umbilicus. It was also found in the Garo Hills, No. 2755, (Plate CLV. fig. 9), *birugosus* var. *minor*, presenting the same characters, only smaller in size, being: major diam. 2·4 and alt. axis 1·1 mm.

An allied species is *A. multirugosus* of N.E. Munipur.

Alycæus canaliculus, n. sp. (No. 2764 B.M.) (Plate CLIV. fig. 11.)

*Locality.* Teria Ghat, foot of the Khasi Hills (*Godwin-Austen*).

Shell umbilicated, globose; sculpture smooth: rather irregular, close, oblique, fine ribbing, not amounting to costulation until nearing the sutural tube, where strong costulation comes in: colour pale ochraceous; spire rather high, apex blunt; suture well impressed, the sutural tube shortish and stout; whorls 4, tumid and rounded, the last is sharply constricted just in front of the sutural tube, and expands again into a narrow ridge, which crosses the whorl diagonally to the edge of the peristome and then splays forward above; aperture circular, oblique angulate above; peristome double, strong, with a decided notch or channel on the lower margin, slightly rounded on the columellar margin, more so on the outer.

Size: maj. diam. 3·1; alt. axis 1·5 mm.

The aperture recalls that of *A. gemma* of the Dafla Hills, but the shell differs in other respects.

Alycæus crispatus, G.-A. (Plate CXLV. figs. 1, 1 *a*, 1 *b*.) No. 2635 B.M.

J. A. S. B. 1871, vol. xl. p. 91, pl. iv. figs. 1, 1 *a*, 1 *b*.

Godwin-Austen, J. A. S. B. 1875, vol. xliv. p. 8, pl. iv. fig. 3 (view of basal side compared with that of *A. sculpturus* from Munipur).

Theobald, Cat. Suppl. 1876, p. 39.

G. Nevill, Hand-list, i. p. 291.

*Original description*:—"Shell moderately umbilicated, turbinate, rather thin, pale horny, with fine subdistant plicate costulation on the upper part of the whorls near the suture, smoother below, finely and closely ribbed on the swollen portion of the last whorl. Spire conoidal, apex rather acute, suture well impressed. Whorls 4, rounded, the last moderately swollen at the side, next constricted and smooth for a short distance, then traversed by a slightly recurved ridge, more developed in some specimens than in others, with a nearly smooth interval behind the mouth, but gradually becoming impressed with longitudinal undulations near the peristome. Sutural tube moderate. Aperture diagonal, waved on the outer and upper margins. Peristome thickened, irregularly double, expanding with 4 or 5 deep undulations on the right side, extending from the point of junction with the last whorl to the base of the aperture; the inner salient angles strongly projecting in aged specimens. Operculum multispiral, thickened, convex behind, very concave in front.

"*Habitat.* Khasia, Jaintia, and N. Cachar Hills. Abundant.

"This form is a close ally of *Alycæus sculptilis*, Bs. A variety was obtained in the eastern side of the hill-ranges near Asálú, &c., and figured in pl. iv. fig. 2; it differs from Benson's Burmese species in having a well-marked ridge on the constriction and an

expanded peristome to which there is no tendency in *A. sculptilis*, Bs."

Major diameter of typical shell, 2·5 mm.

I should not now call *A. crispatus* by any means a close ally of *A. sculptilis*, the subangulate periphery of the latter is very distinctive (*vide* Pl. CXXXIX. figs. 7, 7 *a*). In 1871 I knew but few species, and sometimes had incorrectly named species for comparison. The variety referred to and figured I now distinguish as *A. asaluensis*. In 1871 I was less inclined to separate this Western form from the Eastern. I find now some are distinctive enough to be considered species. The type of *crispatus* is from Shibak, Gabir Valley, near the Garo frontier. At Rywuk, at the base of the Garo Hills, 20 miles farther east, I have a very dwarf variety (No. 2637 B.M.) which I distinguish as var. *rywukensis* (Pl. CLIV. figs. 3, 3 *a*).

Looking over these shells again, and referring back to my field-book, has led to the recovery of a species I had thought was lost—one that I named at the time *A. mokarsæ*, from the village of Mokarsa in the N. Khasi Hills. This species is rather large, is very slightly crenulated, and has no ridge near the constriction. Specimens were sent to Wm. Theobald, who had visited and collected in the country a short time before I was sent on duty there. He introduced the name into his 'Catalogue of the Land and Freshwater Mollusca of India' (1878), p. 40, as *A. makarsæ*, G.-A. MSS. I now describe and figure a specimen from the typical locality. Theobald gives N. Cachar Hills, which is not correct; I may have written to him from North Cachar.

Alycæus crispatus, var. makarsæ. (Plate CLVIII. fig. 13.) No. 2638 B.M.

*A. makarsæ*, Godw.-Aust. (MSS.). North Cachar.

W. Theobald, Cat. Land & Freshw. Shells of British India, 1878, p. 40.

*Locality*. Makarsa, N. Khasi Hills (or more correct, Maokarsa; the common Khasi prefix "Mao" meaning a stone).

Shell depressedly conoid, rather openly umbilicate; sculpture: distant and strong costulation on upper whorls, becoming coarser at the end of the sutural tube, up to the base of same, thence to aperture, very fine close liræ; colour whitish; spire low, apex blunt; suture moderately impressed; whorls 4, rounded, no ridge near the constriction, expanded at the aperture forward, forming a notch near the inner upper side which is conspicuous; aperture ovate; peristome double, broad, solid, with the very slightest approach to crenulation on the outer margin within aperture; columellar margin subvertical, with the outer lip expanded into a flange; operculum very black and smooth.

Size: maj. diam. 3·5; alt. axis 1·5 mm.

It is much larger than typical *crispatus*.

ALYCÆUS CRISPATUS, G.-A., var. MINIMUS, G.-A. (Plate CXLVIII. figs. 5, 5 *a*.) No. 176 coll. W. Blf. (type figured).

*Locality.* Habiang Garo Hills, West Khasi (*Godwin-Austen*).

Shell globosely pyramidal, umbilicated; sculpture: distant costulation on the upper whorls, close, regular, and larger on swell of last whorl; colour whitish; spire conic, sides flat; suture impressed, the sutural tube moderately long; whorls 4, the last swollen next the sutural tube, then constricted and expanding again into a well-defined ridge running diagonally forward and spreading to the undulations of the peristome; aperture circular; peristome double, thickened, crenulated, with strong notches and four blunt processes which, on the outside, are represented by a wavy outer lip.

Size: maj. diam. 2·6; alt. axis 1·2 mm.

This specimen was sent by me to Blanford soon after I had found it. When cataloguing his collection I came on it again. Another specimen (No. 961) is in my own collection.

ALYCÆUS CRISPATUS, var. RYWUKENSIS. (Plate CLIV. figs. 3, 3 *a*.) (3 *b* another example.) No. 2637 B.M.*

*Locality.* Rywuk Valley of the Garo Hills (*Godwin-Austen*).

Shell small, depressedly and globosely conical, well umbilicated; sculpture: strong, distant, and regular costulation above, close and stronger next the sutural tube; colour whitish; spire rather low, apex blunt; suture impressed, the sutural tube fairly long; whorls 3½, well rounded, the last is well constricted in front of base of sutural tube, then rises into a low but defined diagonally directed ridge and spreads forward, showing externally the shallow crenation with a decided notch next the sutural side; aperture irregularly ovate, suboblique; peristome double, crenulated on the upper and outer margin, not so below, and the columellar side rounded and suboblique: the crenulation is not deep, and the first upper fold extends forward and is the most conspicuous (fig. 3 *a*). Such is the description of the peristome of the type, but it is evidently not at full development. In the second example four well-defined notches and folds are seen, the lowest central and basal (fig. 3 *b*).

Size: maj. diam. 2·3; alt. axis 1·0 mm.

This species is undoubtedly close to *A. crispatus*, and had been put down by me some years ago as *crispatus*, small var., but, taken with other varieties, it is something more than that when looked at carefully under the microscope and mounted for drawing. A number of Alycæi collected in many localities, more or less distant from each other, group themselves near *A. crispatus*, and have been regarded as varieties of that species. These varieties differ again

* This is the number in the Register of species in the Godwin-Austen Collection (British Museum) presented to the Trustees.

one from the other. The affix var. at last conveys nothing, and a specified name becomes necessary. This seems the best for those who may study these shells in the future, and they can form their own opinion as to what extent they are species or subspecies. I often feel that if the variety had been discovered and named first it would be the dominant species, and sometimes it is more representative of the group it is cast in. Size does not count for much, but this little Garo Hills shell also differs from typical *crispatus* by its much more depressed and different shape.

Alycæus generosus, n. sp. (Plate CXXXVIII. figs. 8, 8 *a*, 8 *b*.) No. 2566 B.M.

*Locality.* Khasi Hills (*Godwin-Austen*).

Shell tumidly turbinate, umbilicus narrow, much hidden by last whorl; sculpture: only some 10 close costæ next the short suture, the rest of the shell smooth; colour pale ochraceous; spire conic, moderately high, sides flat; suture impressed, tube short; whorls 4, constriction close to sutural tube, at once followed by a ridge which slopes diagonally to the aperture, surface slightly irregular; aperture is nearly circular, subangulate at upper outer margin; peristome double, simple; columellar margin well rounded.

Size: maj. diam. 3·0; alt. axis 1·4 mm.

I regret that I did not record the exact locality of this shell in the Khasi Hills, as it is a very distinct species. Three specimens were obtained, and are in the Natural History Museum.

Alycæus habiangensis, n. sp. (Plate CXXXVIII. figs. 2, 2 *a*, 2 *b*.) No. 2649 B.M.

*Locality.* Habiang Garo, on West Khasi border (*Godwin-Austen*).

Shell minute, turbinate, closely umbilicate, glassy; sculpture confined to about 16 fine close ribs next the sutural tube, the rest of shell showing very indistinct costulation; colour whitish; spire conical; suture impressed, the sutural tube short; whorls 4, the last constricted close to sutural tube, swelling towards the aperture in one broad ridge, having subsidiary undulations; aperture oblique, circular; peristome: example is young, and this is not continuous, it is simple, with no sign of crenation; columellar margin rounded; operculum not present.

Size: maj. diam. 3·0; alt. axis 1·3 mm.

This shell belongs to a group of *Alycæus*, characterized by having a short tube and a narrow band of costulation, the rest of the shell being generally smooth and more or less shiny. *A. khasiacus*, G.-A., is one of the largest of this type of structure; it includes *conicus*, G.-A., *diagonius*, G.-A., and *pusillus*, G.-A.

Alycæus hebes, Bs. (Plate CXLV. figs. 5–5 *b*.)

Land & Freshw. Moll. Ind. vol. i. (1886), pt. v. p. 191, pl. xliii. figs. 1–1 *c*.

Godwin-Austen, J. A. S. B. vol. xl. (1871) pl. iv. figs. 5, 5 *a*, 5 *b*.

A very abundant species at Teria Ghat, south base of Khasi Hills.

ALYCÆUS JAINTIACUS, G.-A. (Plate CXLIII. figs. 3, 3 *a*, 3 *b*.)

Godwin-Austen, J. A. S. B. vol. xl. pt. 2 (1871), p. 92, pl. v. figs. 3, 3 *a*, 3 *b*.
Theobald, Cat. Supp. 1876, p. 39.
G. Nevill, Hand-list, i. 1878, p. 290.

*Original description* :—"Shell subobtusely perforated, turbinate, pale amber or white, smooth, finely ribbed on the swollen portion of the last whorl, with sign of subdistant ribbing behind the termination of the sutural tube. Spire conoid, apex blunt, suture impressed. Whorls 4, rounded, last very slightly swollen, then moderately constricted, swelling again in a low ridge, somewhat recurved. Constriction smooth; sutural tube rather short, fine; aperture subvertical, round. Peristome deeply waved within; salient angles between the undulations nodose; inner lip continuous, outer reflected considerably near the umbilicus.

"Major diam. 0·13″, minor diam. 0·11″; alt. 0·10″; diam. of aperture 0·07″.

"*Habitat.* Obtained on Nongjinghi Hill, Jaintia. By no means abundant."

ALYCÆUS JAINTIACUS, var. CRASSUS. (Plate CXXXVII. figs. 5, 5 *a*.) No. 2752 B.M.

*Locality.* Nongjinghi, Jaintia Hills, 4563 feet (*Godwin-Austen*).

Shell solid, globosely turbinate, narrowly umbilicate; sculpture: a few distant costulate lines on upper whorls, fine and close costulation next the sutural tube; colour whitish; spire conic, rather high; apex blunt; suture impressed; whorls 4, the last with a sharp constriction in front of sutural tube, then expanding into a well-marked ridge inflated towards aperture; aperture circular, vertical; peristome much thickened, double, the outer lip with a flange which nearly hides the umbilicus and is sharply reflected, the inner crenulated on lower margin in three notches.

Size: maj. diam. 3·0; alt. axis 1·75 mm.

This is a variety of *jaintiacus*, collected at the same place and noted at the time in my field-book as new. Only four were found, and it never occurred anywhere else.

ALYCÆUS KAMAKIAENSIS, n. sp. (Plate CXLI. fig. 8.) No. 2705 B.M.

*Locality.* Kamakia Temple Hill near Gowhatty, Assam (*Godwin-Austen*).

Shell turbinate, moderately umbilicated; sculpture: fine, well-marked, close costulation extending a little beyond the length of

the suture, gradually becoming finer and much more distant on nearing the apex; colour a brown epidermis, coming off; spire slightly depressedly conic, apex small; suture impressed, the sutural tube moderately long; whorls 4; aperture oval, angular above, the obscure crenulation on outer margin making it polygonal in outline, suboblique; peristome double, not very thickened; columellar margin vertically curved.

Size: maj. diam. 2·5; alt. axis 1·2 mm.

Until I had compared the two species I had marked this as *polygonoma*, W. Blf., var. On doing so there was no doubt as to the distinctness of the Assam shell. In 1874, when describing *A. burtii*, I wrote as follows:—

"It is close to *A. polygonoma*, but the form of constriction is slightly different, the peristome is well crenulated, and the sculpture stronger. At Kamakia Hill, near Gowhatty, I obtained specimens of an *Alycæus* still nearer in form to *polygonoma*, only that the sutural tube is about half the length, ending abruptly, while in *polygonoma* it is long and thread-like. I shall describe it in my next paper."

Alycæus khasiacus, G.-A. (Plate CXLIII. figs. 7, 7 *a*, 7 *b*.)

Godwin-Austen, J. A. S. B. vol. xl. pt. 2 (1871), p. 90, pl. iii. figs. 4, 4 *a*, 4 *b*.

Hanley & Theobald, Conch. Ind. p. 42, pl. ciii. figs. 5, 6. Very poor figure and over coloured.

Theobald, Cat. Supp. 1876, p. 40.

G. Nevill, Hand-list, i. 1878, p. 290.

*Original description*:—"Shell subturbinately depressed, openly umbilicated, translucent, varying much in colour from horny amber to pink- and dark red-browns; a shining surface, very finely striated under lens, very minute ribbing on the swell of the last whorl; in some specimens a faint costulation is seen. Spire depressedly conoid, apex very blunt, often darker coloured than rest of the shell. Suture impressed, whorls 4, well rounded, last moderately swollen, sharply constricted and again enlarging into two vertical ridges, that nearest the mouth being the least developed, and only extending across the upper portion of the whorl, being cut off by the peristome. Constriction smooth, sutural tube very short and thick at the base. Aperture oblique, round, slightly angulate above. Peristome more or less distinctly double, inner continuous, outer slightly expanded. Operculum multispiral, very concave in front, convex behind, no boss.

"Major diameter 0·15″, minor diam. 0·13″; alt. 0·09″; diam. of aperture 0·07″; sutural tube 0·025″.

"*Habitat.* On the highest parts of the Khasi and Jaintia Hills. Abundant.

"The very short tube and very fine ribbing on the last whorl, and the plain surface of the rest of the shell, combine to make this a very distinct and well-marked species of the genus *Alycæus*.

"A variety has the aperture less circular, with a distinct notch below. In every other respect it is identical, but a little smaller. All found in Shillong Hill Station were of the last type."

This species, only smaller in size and not with the red coloration of the typical Khasi Hills form, occurred on the Trigonometrical Hill Station of Angaoluo in the North Naga Hills. It measures 3 mm. in major diameter as against 3·5 mm. of the type shell. I have true *khasiacus* from Jawai in the Jaintia Hills, from Mairang and Shillong. I also found it in the valley of the Barak, Munipur, and at Asalu in the North Cachar Hills.

Among a large series of this species variation may be noted in a specimen here and there. The two ridges behind the peristome are only slightly developed, blend and nearly disappear. Such examples might be considered, if singly and separately collected, to be a different species. The short sutural tube then shows what the true relationship is.

ALYCÆUS (CYCLORYX) MANGUTENSIS, n. sp. (Plate CXLVI. figs. 5, 5*a*.) No. 2518 B.M.

*Locality*. Mangut Valley, Jaintia Hills (*Godwin-Austen*), Jawai (one specimen sent to Wm. Blanford by me mounted on a glass slide with *otiphorus* from Darjiling).

Shell globosely turbinate, *perforation hidden by outer lip*; sculpture smooth on the two apical whorls, succeeded by close, fine costulation, 5, *rather close, on the short sutural tube*; colour pale ochraceous, some richer, some colourless; spire moderately high, conic; apex blunt; suture impressed; whorls tumid, 4; aperture circular, nearly vertical; peristome double, not thickened; columellar margin an arc of a circle; operculum dark coloured.

Size: maj. diam. 3·2; alt. axis 2·2 mm.

With wider knowledge of these small shells, and a large series for comparison, I consider this species worthy of specific distinction. It was first noticed in 1871, when, in the J. A. S. B. p. 93, it was recorded as *Alycæus otiphorus*, Bs., var., pl. v. fig. 6. I then said: "This is a closely-allied shell to Benson's type, differing, however, in its smaller size, stronger sculpture, and in having very fine lines of sculpture on the constriction, close behind the peristome. . . . *Habitat*. Wooded slopes of the Mangut River and Marangsip Peak, Jaintia Hills. Rather a rare shell. The same variety of *Alycæus otiphorus* was also obtained in North Burma by Dr. Anderson when proceeding with the Mission to Yunnan." This last notice requires verification if I can lay my hand on the specimen referred to.

In the P. Z. S. (1893) shells collected by Mr. Wm. Doherty in the Eastern Naga Hills, led me to write a paper on species of Alycæi, and at page 593 I described *Alycæus* (*Dioryx*) *granum*. I must here say the subgenus *Dioryx* of Benson cannot receive this shell. *Dioryx* is confined to forms like *A. urnula*, the type. Following the original description I wrote:—

"This species is only half the size of its nearest ally, a variety

of *A. otiphorus* from the wooded slopes of the North Jaintia Hills. This variety was figured and described by me in the J. A. S. B. 1871, p. 93, pl. v. fig. 6." After other remarks on *A. granum* I concluded by saying: "The form of the Jaintia Hill shell is again so very distinct from that of the type-species (*otiphorus*) that I think it will be better to distinguish it as *A. granum*, var. *major*."

Compared with the minute *A. granum*, the shell is far larger and more globose, while the umbilical region differs considerably.

Alycæus nongtungensis, n. sp. (Plate CXXXVIII. figs. 5, 5 *a*.)

No. 2692 B.M. Coll. Blf. Coll. No. 175.06.4.4, number in Register B.M. collection.

*Locality.* Nongtung, Jaintia Hills (*Godwin-Austen*).

Shell globosely and tumidly turbinate, closely umbilicated, glassy lustre; sculpture: the costulation is confined to a narrow belt near the sutural tube, a slight indication of distant costulation on the first whorl in front; colour pale burnt sienna; spire low, conic, sides very slightly convex; suture impressed, sutural tube short; whorls 4, well rounded, the last only slightly constricted, and spreads forward from the sutural tube for a considerable distance, with a smooth rounded surface; aperture circular, a slight angulation above; peristome double, continuous, the inner expanded; columellar margin rounded.

Size: maj. diam. 2·8; alt. axis 1·25 mm.

In the 'Journal of the Asiatic Society of Bengal,' 1871, vol. xl. p. 89, I wrote under *Alycæus pusillus* as follows:—"*A. humilis* is common at Nongtung in the Jaintia Hills . . . ." The species was finally considered a variety of the Pegu *humilis*, and I find this confirmed by specimens so named in Blanford's collection which I gave him.

Closer examination on drawing the two forms shows considerable variation in the higher spire and less circular aperture of true *humilis*, though both belong to this smooth, often shining section without sculpture on the upper whorls.

Alycæus obscurus, n. sp. (Plate CLIV. figs. 9, 9 *a*.)

*Locality.* Cherra Poonjee (2 specimens in *coll. John Ponsonby*).

Shell umbilicated, globosely conical; sculpture, fine somewhat distant costulation on the upper whorls, next the sutural tube becoming much stronger and closer; colour whitish; spire conic, sides flat, apex small; suture impressed; whorls 4½, the last sharply constricted close to the sutural tube, then swelling into a sharply curving ridge and expanding forwards to the aperture, about halfway a well-defined narrow ridge extends across the whorl from side to side; aperture oblique, widely ovate, expanding; peristome double, the outer much expanded on the inner lower margin, the inner shows crenulation extending backwards internally, the two combined are vertical on the columellar margin.

Size: maj. diam. 4·0; alt. axis 2·0 mm.

This was among some unnamed Alycæi from Cherra Poonjee and Teria Ghat, kindly sent to me by Mr. John Ponsonby. I have nothing like it in my own collection from those places and I have reason to think the locality correct. It has several well-marked characters.

Alycæus pusillus, G.-A. (Plate CXLIII. figs. 6, 6 *a*, 6 *b*.)

Godwin-Austen, J. A. S. B. vol. xl. pt. 2 (1871), p. 89, pl. iii. fig. 3.
Hanley & Theobald, Conch. Ind. 1870, p. 42, pl. ciii. figs. 7–10.
Theobald, Cat. Supp. 1876, p. 40.
G. Nevill, Hand-list, i. 1878, p. 290.

*Original description*:—"Shell depressedly turbinate, moderately umbilicated, thin, translucent, vitreous, pale horny, smooth, rarely showing any signs of costulation; the sculpture when present is very fine and distant; closely and regularly ribbed on the expansion of the last whorl, also within the umbilicus. Spire depressedly conoid, apex blunt, suture moderately impressed, whorls $3\frac{1}{4}$, the last scarcely swollen. Constriction very slight, smooth, sutural tube very short and thick; aperture oblique, round, peristome double, inner continuous, both lips expanded. Operculum thin, horny, transparent, multi-spiral, slightly concave and without central boss at back.

"Major diam. 0·09″, minor diam. 0·075″; alt. 0·055″; diam. of aperture 0·035″; sutural tube 0·012″.

"*Habitat.* This shell was first found by me near Jawai, it is an abundant form in some localities, especially on the banks of the Kopili river on the road from Jawai to Asálú, viâ Súfai.

"The species is very similar to *A. humilis*, described by Mr. W. T. Blanford from Akouktoung, Burma, but this last is a larger, thicker shell, and the outer lip is reflected near the umbilicus which is not so open, as in the new shell above described." "On a comparison of the Alycæi in Mr. W. T. Blanford's collection, and those obtained by me, *A. humilis* also turned up (vide *A. nongtungensis*); I had previously noted the shell as differing from *A. pusillus*."

"*A. humilis* is common at Nongtúng in the Jaintia Hills; it has also been found in the W. Khasi Hills, and as far east as the Jhiri river on the border of Munipúr; in this last locality the form is again slightly different with a shorter constriction, and approaches *A. conicus*, n. sp."

In a paper by Theobald and Stoliczka, this species is said to occur at Nattoung in the Mendon district, Pegu. I have seen an example from this locality, kindly sent me by Mr. N. Annandale; it is noted in Nevill's Hand-list at the top of p. 291 "? distinct species," this I consider it to be, having compared it with the type of *A. pusillus*, and I propose to name it *A. nattongensis*.

From Teria Ghat I have a single example of a shell closely allied to this species, and were there more I would figure it, because it differs in two characters—the general form and distant

costulation. The typical form is smooth and the first three whorls are much more tumid.

I found this species in the Eastern Garo Hills, and at Asalu in the N. Cachar Hills.

Alycæus perplexus, n. sp. (Plate CLV. fig. 11.) No. 2756 B.M. Coll.

*Locality.* Khasi Hills.

Shell globosely conical, openly perforated; sculpture smooth to eye, but it is extremely fine close costulation, close and fairly strong on swollen portion near the sutural tube, which is long and very fine; colour strong ochraceous brown; spire high, conic; suture well impressed; whorls 4, well rounded, the constriction slight in front of the sutural tube, then swelling slightly toward the aperture, this is oval, subangulate above, subvertical on columellar side; peristome double, slightly reflected, much broader on outer margin than on the inner; operculum closely multispiral, pale in colour, with a rather deep central depression.

Size: maj. diam. 3·75 mm.

This species is not far removed from *A. theobaldi*; it is smaller and more conical, the aperture differs considerably as well as the sculpture. There are three examples, the exact locality was not recorded.

Alycæus prosectus, Bs. (Plate CXLIII. figs. 1, 1 *a*, 1 *b*.)

Benson, A. M. N. H. March 1857, ser. 2, vol. xix. p. 203.

Pfeiffer, Mon. Pneum. vol. ii. p. 36; Novit. vol. i. pl. 35, figs. 21–23.

Hanley & Theobald, Conch. Ind. p. 38, pl. xcii. figs. 2, 3.

Theobald, Cat. Supp. 1876, p. 40.

Godwin-Austen, J. A. S. B. vol. xl. pt. 2 (1871), pl. v. figs. 1, 1 *a*, 1 *b*.

Original description:—"*Testa mediocriter umbilicata, subcampanulato-depressa, subremote striatula, striis elevatis spiralibus remotiusculis cincta, ad spatium inflatum anfractus ultimi confertissime et acutissime costulata, albida, versus apicem mucronatum rubella; spira brevi, sutura profunda; anfractibus 4 convexis, subapicali exserto, ultimo ad latus pone stricturam valde gibboso, tubulum suturalem mediocrem gerente, antice læviori; apertura valde obliqua, circulari; peristomate simplici vel duplici, interiori duplicis expansiusculo, exteriori dilatato, superne ad angulum et ad basin alato-producto, margine columellari angusto. Operculo concavo, lævi, multispirato.*

"Diam. major 7, minor 6; axis 5 mm.

"*Habitat.* Teria Ghat," extending west to the Habiang Garo Hills and east to South Jaintia.

"Found abundantly on rocks by Mr. Theobald.

"It is related to the Burmese *A. umbonalis* (Annals, vol. xvii.

p. 225) and to *A. strangulatus*, Hutton. Inferior in size to the former, it is easily distinguished by its sculpture and by the peculiar development of the outer lip at its insertion and base, while the narrow columellar lip gives an appearance of artificial truncation to the peristome at that part. In the variety the internal lip is not developed. The margins of the whorls in the operculum are not conspicuously raised as in *A. umbonalis*."

ALYCÆUS PROSECTUS, Bs., var.

*Locality*. Cherra Poonjee (*coll. John Ponsonby*).

I have seen two specimens in the above collection which are smaller than the usual typical form, and though quite similar in shape, show a decided tendency to crenulation on the outer margin of the peristome; a similar tendency I have observed in other species.

Some specimens from Teria Ghat are as much as 8 mm. in major diameter; it varies much in size even from this locality, fully grown examples being only 6 mm. From some places all are small, and G. Nevill distinguished them as var. *minor*.

From Rywuk, at the foot of the Garo Hills, the form differs considerably in having a tendency to a crenulate peristome which I figure and describe.

ALYCÆUS STRIGATUS, G.-A. (Plate CXLIV. figs. 2, 2 *a*, 2 *b*.)

Godwin-Austen, J. A. S. B. xliii. pt. 2, 1874, p. 146, pl. iii. fig. 2.

Theobald, Cat. Supp. 1876, p. 40.

G. Nevill, Hand-l. i. p. 291. Assam (type), Dr. F. Stoliczka.

Von Möllendorff, Nachrbl. Deutsch. Malak. Ges. 1897, p. 148.

Subgenus *Orthalycæus*.

*Original description*:—"Shell pale corneous or amber, finely and evenly costulated throughout. Spire depressed, apex blunt and darker coloured. Suture moderate. Whorls $3\frac{1}{2}$, the last very little swollen, slightly constricted, with a single low ridge close behind the aperture, the constriction smooth and very finely striated. Sutural tube very short. Aperture slightly oblique, circular; peristome single, simple, continuous, moderately thickened. Operculum . . . . ?

"*Hab.* Assam in collection Ferd. Stoliczka.

"Major diam. 0·15", minor diam. 0·11"; alt. 0·08"; diam. ap. 0·05".

"This is another species of the short-sutural-tubed section of *Alycæus*, of which *A. khasiacus* (vide pl. iii. fig. 4, J. A. S. Bengal, vol. xl. pt. 2, 1871) is a good type. The general and distinct costulation from constriction to apex, particularly the form of constriction and mouth, mark it as a good species. It is more openly umbilicated than *A. khasiacus*."

Alycæus sylheticus, n. sp. (Plate CLIV. figs. 4, 4 *a*.) No. 55 B.M. G.-A. Coll.

*Locality.* South Sylhet Hills (*W. Chennell*).

Shell globosely conoid, openly umbilicated; sculpture: strong costulation and rather distant at the base of the sutural tube, becoming closer posteriorly: on the upper whorls the costulation is distant: colour dull white, with a pink apex; spire rather depressedly conoid, apex blunt; suture moderately impressed; whorls 4, the last swelling next the sutural tube, which is fairly elongate—constriction short, then swelling slightly forwards; aperture horizontally ovate, angular at the upper inner margin, rounded below; peristome double, the outer reflected and expanded to an extreme extent on the columellar side.

Size: major diam. 2·6; alt. 1·7 mm.

Only one specimen was found, but that is in excellent preservation.

Alycæus teriaensis, n. sp. (Plate CLIV. figs. 10, 10 *a*.) No. 2750 B.M.

*Locality.* Teria Ghat, foot of the Khasi Hills (*Godwin-Austen*).

Shell rather closely umbilicated, globosely pyramidal; sculpture: surface smooth on the whole, distant fine costulation on the upper whorls, crossed by some 5 or 6 very distinct longitudinally fine lirate lines; strong costulation next the sutural tube; colour whitish; spire high; suture well impressed, sutural tube moderately long; whorls 4½, sides very rounded; the distance from aperture to sutural tube short and constricted; aperture quite circular, suboblique; peristome double, broad and flat, and expanded on the outer margin, very narrow on the columellar side; operculum situated near the aperture, very dark brown, with a central circular hollow.

Size: major diam. 3·9; alt. axis 2·0 mm.

The longitudinal sculpture is a very distinguishing feature of this species. In form it is very similar to *A. inflatus* of the Naga Hills.

Alycæus theobaldi, W. Blf. (Plate CXLV. figs. 4, 4 *a*.)

J. A. S. B. vol. xxxi. (1862) p. 142.

Pfr. Mon. Pneum. vol. iii. p. 49.

Original description:—"*Testa aperte umbilicata, conoideo-depressa, corneo-albida, translucens, costulis elevatis, sinuatis, remotis ornata, intercostulas striatula. Spira depresso-conica, apice obtusula, sutura impressa. Anfractus 3½ convexi, ultimus ad latus mediocriter tumidus, ibidem confertissime costulatus. Spatium constrictum longum, striatulum, medio tumidum. Tubulum suturale, mediocre, ¼ peripheriæ subæquans. Apertura obliqua, expandens, circularis; peristoma ad anfractum penultimum breviter interruptum, marginibus callo junctis, duplex; externo expansulo, interno*

*breviter porrecto. Operc. corneum, multispirum, externe perconcavum, nucleo centrali interno prominente papillari.*

"Diam. maj. 4, minor 3·25; alt. 2·5 mm.

"*Hab.* Cum *A. hebeti* in montibus, Khasi, teste W. Theobald, jun.

"I received two specimens of this species from Mr. Theobald as *A. hebes*, Bens., of which they were supposed to be young shells. They, however, prove on closer examination to be fully grown and distinct, the slight swelling in the centre of the constriction contrasting strongly with the high recurved ridge in *A. hebes*. This alone would show the present to be a different species, but it is also distinguished by its lower spire, narrower umbilicus, smaller size, and thinner and interrupted peristome, the last character not occurring in any other species of the genus. The well-marked distant costulation of the upper whorls of *A. Theobaldi* is entirely wanting in *A. hebes*. The operculum of the latter does not appear to have been described. A single specimen in my possession is dark horny, indistinctly multispiral, extremely concave in front, and convex almost conical behind and deficient in the central internal boss so prominent in most Alycæi.

"Although there is a swelling in the centre of the constriction in *A. Theobaldi* it does not amount to a marked ridge, such as characterizes the typical forms of the section *Charax* of Mr. Benson, e. g. *A. stylifer*, B. It is consequently not clear whether this species should be classed with the members of that section, or with those of the typical group. Several species indeed tend to connect these two subdivisions, which more recent discoveries have rendered less distinct than they appeared to be when first described."

With the now far more numerous known species, it becomes still more difficult to define the limits of *Charax*, as to character, or to break the genus *Alycæus* up into sections as Benson and Blanford attempted to do.

This species is variable in size, retaining its principal characters. Thus from the North Khasi Scarp, near Maotherichan Trigonometrical Station, I obtained 8 specimens (No. 2609 B.M.) far larger than those from Cherra Poonjee. Three of the largest measure 5 mm. in major diameter as against 4 from the last-named locality. It was found at Shillong and Jawai.

Alycæus theobaldi, W. Blf., var. solidus, G.-A. (Plate CLV. fig. 10.) No. 2560 B.M.

*Locality.* Garo Hills (*Godwin-Austen*).

Shell depressedly and conoidly globose, openly umbilicated, solid; sculpture very distant, strong costulation above, next sutural tube, which is not very long—there are 23 ribs, nearly twice as strong as in typical *theobaldi*, which has about 36, much closer together: colour pale ochraceous; spire low; suture impressed; whorls 4, rounded, constriction sharp, swelling slightly to the aperture, the distance being greater than in *A. theobaldi*; aperture nearly

circular, angulate above, and much expanded; peristome double, inner continuous, outer much expanded but not reflected.

Size: major diam. 3·5; alt. axis 1·6 mm.

Five of this pretty form are in the collection; although very close to *A. theobaldi*, it is easily distinguishable in its size, general form, and sculpture. In another tube four other specimens were found (No. 2663) from North Khasi.

In 1871 I gave in J. A. S. B. pl. v. fig. 4 (reproduced Plate CXLIII. fig. 9) a figure of *A.* (*Dioryx*) *urnula*, Bs., but with neither a description nor notice—its habitat was Marangsip Peak in the South Jaintia Hills. A close comparison of shells from this locality with Darjiling typical shells shows considerable difference, sufficient for record. I propose to distinguish it as *Alycæus* (*Dioryx*) *urnula*, Bs., var. *pisum*, and with it I include the *Dioryx* from Nongjinghi (No. 2526), also (No. 2524) from the Eastern Garo Hills.

This variety may be known by a more globose shape and a more depressed spire than in the type species.

ALYCÆUS (DIORYX) URNULA, var. PISUM. (Plate CLIII. figs. 3, 3 *a*.)

*Locality*. Nongjinghi Trigonometrical Station, 4563 feet, Jaintia Hills (*Godwin-Austen*).

Shell globosely conoid; colour whitish to pale pink ochraceous; spire moderately high, apex blunt; suture well impressed, the tube moderately long; whorls 4, the last very tumid; aperture circular; peristome moderately thickened; operculum multispiral, central portion rather raised above the marginal whorls.

The specimens from Marangsip Peak are most richly coloured in tints of pink and ochre.

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6. *North Cachar, Naga Hills, and Munipur.*

| | |
|---|---|
| *Alycæus asaluensis*, n. sp. | Pl. CXLV. figs. 2, 2 *a*, 2 *b*. |
| *beddomei*, n. sp. | Pl. CXLIX. figs. 5, 5 *a*. |
| *bicrenatus*, G.-A. | Pl. CXLIV. figs. 5, 5 *a*, 5 *b*. |
| *birugosus*, G.-A. | Pl. LXIII. figs. 5, 5 *a*. |
| (*Cycloryx*) *burrailensis*, n. sp. | Pl. CXLVII. figs. 6, 6 *a*. |
| *chennelli*, G.-A. | Pl. XLVIII. figs. 1–1 *c*. |
| *chennelli*, G.-A., var. | Pl. XLVIII. fig. 2. |
| *conicus*, G.-A. | Pl. CXLIII. figs. 4, 4 *a*, 4 *b*. |
| *conicus*, var. *nanus*. | Pl. CXXXVIII. figs. 6, 6 *a*, 6 *b*, and fig. 7. |
| *crenatus*, G.-A. | Pl. CXLIII. figs. 8, 8 *a*, 8 *b*. |
| *diagonius*, G.-A. | Pl. CXLIII. figs. 5, 5 *a*, 5 *b*. |
| *distinctus*, G.-A. Type. | Pl. CXLV. figs. 3, 3 *a*, 3 *b*. |
| *distinctus*, G.-A., var. | Pl. CXLIX. fig. 4. |

| | |
|---|---|
| *distinctus*, var. | Pl. CXXXVII. figs. 2, 2 *a*, 2 *b*. |
| *duorugosus*, n. sp. | |
| *edei*, n. sp. | Pl. CXLIX. figs. 2, 2 *a*. |
| *globulus*, G.-A. | Pl. CXLIV. figs. 4, 4 *a*, 4 *b*. |
| (*Cycloryx*) *graphicus*, var. *variabilis*. | Pl. CXLVI. fig. 4. |
| *graphicus*, var. *dihingensis*. G.-A. | Pl. CXLVI. figs. 6, 6 *a* |
| *inflatus*, G.-A. | Pl. CXLIV. figs. 1 *b*, 1 *c*, 1 *d*. |
| *inflatus*, G.-A., var. | Pl. CXLIV. figs. 1, 1 *a*. |
| *kezamaensis*, n. sp. | Pl. CXLIX. fig. 1. |
| *khasiacus*, G.-A. | |
| (*Cycloryx*) *khunhoensis*, G.-A. | Pl. CXLIV. figs. 9, 9 *a*.<br>Pl. CXLVII. fig. 8. |
| *lahupaensis*, n. sp. | Pl. CXLI. figs. 3, 3 *a*. |
| *levis*, n. sp. | Pl. CXXXVIII. figs. 3, 3 *a*. |
| *logtakensis*, n. sp. | Pl. CLV. fig, 6. |
| *magnus*, G.-A. | Pl. CXXXVIII. figs. 1, 1 *a*. |
| (*Cycloryx*) *multicostulatus*, G.-A. | Pl. CXLVII. fig. 7. |
| *multirugosus*, G.-A. | Pl. CXLIV. figs. 7, 7 *a*. |
| *muspratti*, Beddome. | Pl. CXLVIII. fig. 1. |
| *nagaensis*, G.-A. | Pl. CXLIII. figs. 2, 2 *a*, 2 *b*. |
| *nowgongensis*, n. sp. | Pl. CXXXVII, figs. 4, 4 *a*, 4 *b*. |
| *peilei*, Preston. | |
| *pusillus*, G.-A. | Pl. CXLIII. figs. 6, 6 *a*, 6 *b*. |
| *sculptilis*, Bs., var., Nevill. | |
| *sculpturus*, G.-A. | Pl. CXLV. figs. 6, 6 *a*, 6 *b*. |
| *serratus*, G.-A. | Pl. CXLIV. figs. 6, 6 *a*, 6 *b*. |
| *stoliczkii*, G.-A. | Pl. CXLIV. figs. 3, 3 *a*, 3 *b*. |
| *stoliczkii*, var. | |
| *strigatus*, G.-A. | |
| *subculmen*, G.-A. | Pl. LXIII. figs. 4, 4 *a*. |
| *subinflatus*, n. sp. | Pl. CLIV. figs. 8, 8 *a*. |
| *tanghali*, n. sp. | Pl. CXXXVII. figs. 3, 3 *a*, 3 *b*. |
| *theobaldi*, Blf., var. *diyungensis*, G.-A. | Pl. CXXXVIII, fig. 4. |
| (*Cycloryx*) *thompsoni*, n. sp. | Pl. CXLVI. figs. 3, 3 *a*. |
| (*Dioryx*) *urnula*, Bs., var. *anghamiensis*. | Pl. CLIII. figs. 5, 5 *a*.<br>Pl. CLIII. figs. 6, 6 *a*. |
| *urnula*, var. *pisum*. | Pl. CLIII. fig. 10. |
| (*Dioryx*) *varius*, n. sp. | Pl. CLVII. figs. 7, 7 *a*. |

ALYCÆUS ASALUENSIS, n. sp. (Plate CXLV. figs. 2, 2 *a*, 2 *b*.)
No. 2636 B.M. Type.

There are specimens also from Neuglo No. 2753, and Phulong No. 2762 B.M.

*A. crispatus*, var., Godwin-Austen, J. A. S. B. 1871, vol. xl. p. 93, pl. iv. fig. 2.

*Original note*:—" A variety (*crispatus*) was obtained in the eastern side of the hill ranges near Asalu &c. and figured in pl. iv. fig. 2."

*Locality*. Dihung River, N. Cachar, north of Asalu (*Godwin-Austen*).

Shell umbilicated, conoid; sculpture strong, regular, rather distant costulation on the upper whorls, much stronger and closer on the swell of the whorl next the sutural tube, a few finer and distant on the constriction, which continue up to the aperture; colour whitish; spire conical, fairly high; suture impressed, sutural tube very fine; whorls 4, the last sharply constricted, then rising suddenly into a ridge which expands forwards to the double peristome; aperture circular, very oblique; peristome double, distinctly crenulated, but not strongly so, this is not seen in the figure, which was taken too much from the side to see it well.

Size: maj. diam. 3·5; alt. axis 2·0 mm.

It is more closely wound and smaller than *A. crispatus.*

Alycæus beddomei, n. sp. (Plate CXLIX. figs. 5, 5 *a*.) No. 294 Beddome Coll.

*Locality.* Naga Hills.

Shell very globosely conoid, rather closely umbilicated; sculpture: regular, close, costulation next the long sutural tube, indistinct and distant on the upper whorls, very fine, close longitudinal liration is very marked; colour pale umber; spire rather high conic, apex blunt; suture very well impressed; whorls 4, very convex, constriction slight close to the sutural tube, thence to aperture short; aperture ovate, subvertical; peristome double, solid on the outer margin, much reduced in thickness on the inner in four of these shells in which the peristome was not so mature, angulation was noted on the outer margin by 2 faint indentations (fig. 5 *a*); operculum rather solid, horny, concentric.

Size: maj. diam. 4·5; alt. axis 2·5 mm.

There were ten examples of this species in Colonel Beddome's collection, no doubt collected by Mr. Muspratt, most probably from the Eastern Naga Hills.

Alycæus bicrenatus, G.-A. (Plate CXLIV. figs. 5, 5 *a*, 5 *b*.) No. 2490 G.-A. Coll. B.M.

Godwin-Austen, J. A. S. B. vol. xliii. pt. 2, 1874, p. 148. pl. iii. figs. 5, 5 *a*, 5 *b*.

Theobald, Cat. Supp. p. 39.

G. Nevill, Hand-list, i. 1878, p. 291.

*Original description.*—"Shell moderately umbilicated, sub-turbinate, pale corneous or nearly white; fine close ribbing on swell of last whorl, extending to behind the termination of the sutural tube and thence to apex very finely and evenly costulated. Spire depressedly conoid, suture impressed, apex blunt. Whorls 4, the last moderately swollen, constriction rather wide, followed by a single well-defined high ridge close behind the expanded portion of the aperture, where it is defined by a sharp narrow costulate rib. The expanded portion anterior to this is longitudinally waved on the surface, produced by two deep triangular grooves situated well

within the aperture and on the outer margin. Sutural tube short. Apertures oblique, peristome round, slightly angular above. Operculum, pale horny, concave.

"Major diam. 0·14″, minor 0·10″, alt. 0·09″.

"*Habitat.* Kopamedza Peak, Naga Hills, 8–9000 feet, in forest.

"This shell belongs to the same group as the last (*A. globulus*) and is very close to *A. crenatus*, mihi (*vide* Plate III. fig. 5, J. A. S. B. Pt. 2, 1871), but the longer sutural tube and the strongly crenated peristome of *crenatus* mark the distinction."

ALYCÆUS BIRUGOSUS, G.-A.

Godwin-Austen, P. Z. S. 20th June, 1893, p. 593; Moll. Ind. vol. ii. 1897, pt. 7, p. 2, pl. lxiii. figs. 5, 5 *a*.

ALYCÆUS CHENNELLI, G.-A.

Moll. Ind. vol. i. pt. 5, p. 192, pl. xlviii. figs. 1–1 *c*.

Piknui, Trigonometrical Station, Naga Hills.

ALYCÆUS CHENNELLI, var.

Moll. Ind. vol. i. p. 192, pl. xlviii. fig. 2.

Lhota Naga Hills.

ALYCÆUS CONICUS, G.-A. (Plate CXLIII. figs. 4, 4 *a*, 4 *b*.)

Godwin-Austen, J. A. S. B. xl. pt. 2, 1871, p. 87, pl. iii. fig. 4; Hanley & Theob. Conch. Ind. 1870, p. 42, pl. ciii. figs. 8, 9, not good and over-coloured; Theobald, Cat. Supp. p. 39; G. Nevill, Hand-l. i. 1878, p. 291.

*Locality.* Samiamri, East of the Kopili River. No. 2674 B.M.

*Original description.*—"Shell narrowly umbilicated, turbinate, thick, translucent, pale corneous, pink or white, quite smooth, with shining lustre in fresh shells, with very strong regular filiform costulation on the tumid portion of the last whorl, the sculpture terminating abruptly both in front and behind with the exception of some raised striæ close behind the termination of the sutural tube; indistinct ribbing near the umbilicus. Spire conoid, apex obtuse; suture impressed; whorls 4–4½, rounded, last very slightly swollen, constricted and enlarging slightly again near the aperture. Constriction smooth, rather short; sutural tube moderate, commencing at ·045 inch distance from the mouth. Aperture slightly oblique, a perfect circle; peristome double, thick, inner continuous, projecting, slightly expanded, the outer retroreflect. Operculum horny, multispiral, concave in front; smooth behind, no central boss.

"Ordinary size.—Major diam. 0·12″ to 0·13″, minor diam. 0·11″; alt. 0·10″ to 0·11″; diam. of aperture 0·06″; sutural tube, 0·045″.

"*Habitat.* Was abundant on the Limestone Hill east of the Kopili river, North Cachar District, and was occasionally also found in other places, but rare.

"This shell is very close to *Alycæus vestitus*, W. Blanford, but differs in its smaller size, the upper whorls being quite smooth, and in the ribbing near the sutural tube being more strongly and coarsely marked and in ending abruptly with it."

ALYCÆUS CONICUS, G.-A., var. NANUS, G.-A. (Plate CXXXVIII. figs. 6, 6 *a*, 6 *b*.) No. 2675 B.M.

*Locality.* Jatinga Valley, North Cachar Hills (*Godwin-Austen*).

This is a very marked variety of the type species from the Nummulitic Limestone hills of the Kopili Valley some 30 miles distant to the north. It differs first in the much smaller size, next in the height of spire, it is altogether smoother, no sign of any distant costulation on the first whorl, which true *conicus* shows in some specimens. For comparison I give the size of both species:—

| | | | |
|---|---|---|---|
| *Conicus*: | maj. diam. 3·0; | alt. axis 2·2 mm. | |
| Dwarf var. | ,, 2·6 | ,, 1·5 ,, | |

It also was found in the Jhiri Valley, No. 2693 B.M. (Plate CXXXVIII. fig. 7.) The peristome very much thickened. Other examples from Hengdan Peak, No. 2676, and from Phulong, North Cachar, No. 2669.

ALYCÆUS CRENATUS, G.-A. (Plate CXLIII. figs. 8, 8 *a*, 8 *b*.)

Godwin-Austen, J. A. S. B. vol. xl. pt. 2, 1871, p. 90, pl. iii. fig. 5.

Hanley & Theob. Conch. Ind. 1870, p. 42, pl. ciii. figs. 2, 3. Figure bad and *over-coloured*.

Theobald, Cat. Supp. p. 39.

G. Nevill, Hand-list, i. p. 291.

Godwin-Austen, J. A. S. B. vol. xliii. pt. 2, 1874, p. 150.

*Original description*:—"Shell moderately umbilicated, depressedly turbinate, rather thin, translucent, pale horny or white; epidermis of former colour, peeling off in old shells, with very fine indistinct costulation throughout, fine close ribbing on the swell of the last whorl. Spire depressedly conoid, apex very blunt, suture well impressed. Whorls 4, rounded, the last moderately swollen, constricted close to base of sutural tube, with a marked subvertical ridge just behind the mouth. Constriction smooth, sutural tube long, rather thick; aperture oblique; peristome round, deeply waved on the upper and outer but not on the columellar margin, outer lip smooth, slightly expanded. Operculum multispiral, concave in front, with a small projecting base at the back. Animal pale coloured, tentacles dark brown.

"Major diam. 0·18″, minor diam. 0·16″; alt. 0·11″; diam. of aperture 0·08″; sutural tube ·075″.

*Habitat.* On Burrail Range, N. Cachar, at about 5000 feet.

"Near *A. plectocheilus*, but much larger, the ridge more distant from the peristome and the latter more expanded. In some specimens the edges of the outer whorls in the operculum are much raised and bent inwards as in *Cyathopoma*."

In 1874, I noted that "*A. crenatus* was found as far east as Sheroïfurar, also at Kezakenomih and Yemai."

I described this species in 1871 from specimens collected in the N. Khasi Hills and in North Cachar, 150 miles apart. Giving the Burrail Range as the habitat, the type shell was not indicated—at that time it was not very usual to do so. On going through my collection I very fortunately came across two shells gummed on black paper from which the drawings for Plate IV. 1871, were made. Thus the type can now be put down certainly as from Mokarsa in the N.W. Khasi Hills, No. 2642. Examples from Hengdon Peak, N. Cachar Hills, No. 2645 I regard as like type. Others are Jatinga Valley, No. 2578 (rather small), and from the Diyung Valley, 2644. Specimens No. 170, Blanford Collection, were sent to him by me from North Cachar. No appreciable difference can be found between the western and eastern shells, one only, that in the latter the last whorl, behind the aperture and within the umbilicus, is more rounded—in the western there is a decided keel. From the Lhota Naga Hills, one example, No. 2643, must be considered a variety; it is closer wound with closer umbilicus and whorl subangulate near it, and is worthy of figuring hereafter, with some other species; to do so now would delay publication, delayed already too long.

ALYCÆUS CRISPATUS, G.-A.

I found this species also at Lokah in the Jatinga Valley, North Cachar. No. 2640 B.M. Coll.

ALYCÆUS DIAGONIUS, G.-A. (Plate CXLIII. figs. 5, 5 *a*, 5 *b*.) No. 2678 B.M. Type.

J. A. S. B. 1871, vol. xl. p. 88, pl. iii. figs. 2, 2 *a*, 2*b*.

*Alycæus diagonius*, Hanley & Theob. Conch. Ind. p. 42, pl. ciii. fig. 1.—This figure is quite useless for any purpose of identification; the shell is drawn viewed from below only, and is overcoloured.

*Alycæus diagonus*, Theob. Supp. Cat. p. 39.

*Alycæus diagonius*, Nevill, Hand-list, i. p. 290.

*Original description*:—"Shell closely umbilicated, turbinate, thin, translucent, pale amber or pinkish colour, finely but distantly costulated on the two last whorls, closely so on the inflated portion of the last: spire conoid, apex blunt, suture well impressed; whorls 4, rounded, constricted closely near base of the sutural tube, then swelling largely towards the mouth, the commencement of the swell forming a diagonal or recurved ridge above; constriction smooth, sutural tube 0·053 inch; aperture diagonal, circular;

peristome sinuate, double, inner lip continuous, outer expanded, slightly reflected at umbilicus and partially concealing it.

"Operculum concave in front, convex behind with a small central boss or nucleus.

"Major diam. 0·145″, minor diam. 0·120″, alt. 0·10″, diam. of aperture 0·75″.

"*Habitat.* The Diyung Valley, north of Asálú, in N. Cachar District.

"This shell is at first sight very like *A. hebes*, Bs., but can easily be distinguished by its much narrower umbilicus, its more polished surface and less expanded mouth.

"A small variety of this shell was obtained and deserves special notice. The striation is wanting throughout, and the costulation on the swollen portion of the last whorl is somewhat shorter; in these characters it approaches very near to *A. nitidus*, W. Blanford, from Arakan, but the recurved rib is in this last species much less developed."

ALYCÆUS DISTINCTUS, G.-A. (Plate CXLV. figs. 3, 3 *a*. 3 *b*.) No. 2619 B.M. Type.

P. Z. S. 1893, p. 592.

*Alycæus ingrami*, W. Blf., var., Godwin-Austen, J. A. S. B. vol. xl. pt. 2, 1871, p. 92, pl. iv. figs. 3, 3 *a*, 3 *b*; id. vol. xliii. pt. 2, 1874, p. 150.

*Original description*:—"Differs from the described form from Arakan, in the mouth being larger, and there is a tendency to undulation on the outer margin of the peristome, generally 2 notches are present.

"Major diameter 0·24″, minor diam. 0·24″, alt. 0·16″: diam. of aperture 0·11″; sutural tube 0·09″.

"*Habitat.* Neighbourhood of Asálú, N. Cachar Hills.

"This shell assimilates in some respects *A. prosectus*, Bs."

I wrote in P. Z. S. 1893, as follows:—"In 1871 (J. A. S. B. pl. iv. fig. 3) I figured an *Alycæus* from the Naga Hills as *A. ingrami*, var. (No. 167.06.4.4 Blf. B.M. Coll.). A comparison of it with typical specimens of *A. ingrami* from typical locality now shows me that it is quite distinct, and I therefore name it *distinctus*. I referred to the same species again in 1874 (J. A. S. B. 1874, p. 150) and gave the many localities where I had subsequently obtained it." I then said "*A. ingrami*, var. is the commonest form in the Naga Hills and has a great range in altitude, being found at Dimapur in the Dumsiri Valley under 300 feet and as high as 7000 feet at Khunho Peak on the Burrail range, also at Laisen Hill and Sikhami, and on the east side of the Munipur Valley on the slopes of Nongmaiching and Mungching." "I have lately received from Colonel Beddome, also from the Naga Hills, examples of the same shell, which have led me to recompare the two forms."

No. 2627 B.M. is from the Lhota Naga Hills.

ALYCÆUS DISTINCTUS, G.-A., var. (Plate CXLIX. fig. 4.)

*Locality.* Naraindhur, Cachar, No. 3038 B.M. Type (*F. Ede*).

Shell globosely conoid, umbilicated; sculpture confined to the swell of the last whorl, where the costulation is close and rather fine; colour whitish, sometimes with a pink tinge on the apex; spire high, apex rather fine; suture well impressed; whorls 4, well rounded; aperture ovate, subvertical; peristome double, vertical, curved on the columellar margin and much thickened at its base, very short angulation on the outer lower margin, curving over above.

Size: maj. diam. 5·0; alt. 2·5 mm.

ALYCÆUS DISTINCTUS, G.-A., var. No. 2576 B.M. Type.

*Locality.* Jatinga Valley, N. Cachar Hills (*Godwin-Austen*).

The specimens collected in this valley, 19 in number, differ from the type from near Asalu. It is quite a passage variation, displayed in the outer margin of the peristome which has not got the distinct notches of the shells that come in on the eastward, also in the general shape of the shell, which is higher in the spire, thus more conical, the sculpture coarser and umbilicus smaller.

This variety was also obtained in South Sylhet (3042) by Mr. Wm. Chennell. In N. Khasi (No. 3630) and Garo Hills (2559). It thus has an unusually extended range for species of the genus.

AYLCÆUS DUORUGOSUS, n. sp.

*Locality.* Burrail Range, Naga. No. 2771 B.M. Coll. Type. (*Godwin-Austen.*)

Also Angaoluo Trigonometrical Station, No. 2572; South Barak, No. 2629, and Munipur, No. 2654 B.M.

Shell very globose, umbilicated: sculpture smooth on the upper whorls, with indistinct striation, distant costulation on the last whorl, very fine and regular next the suture; colour umber-brown; spire high; suture impressed, the sutural tube short and thick; whorls 4, much rounded, the constricted part near sutural tube is fairly long, succeeded by two ridges well defined and both of nearly equal size lying close up to the peristome; aperture circular, somewhat flat above, well rounded below; peristome double, somewhat thickened and reflected. Columellar margin curving perpendicularly.

Size: maj. diam. 3·75; alt. axis 2·0 mm.

This, at first sight, recalls *A. birugosus*, of the Khasi Hills, but is larger, more globose, the ridges near aperture more developed, the aperture quite circular without the notch on the lower margin. It is near *A. khasiacus*, but smaller; the ridges in that species are unequal, the anterior much the smallest.

ALYCÆUS EDEI, n. sp. (Plate CXLIX. figs. 2, 2 *a*.)

*Locality.* Naraindhur, Cachar, No. 1665 B.M. (*F. Ede*).

Shell openly umbilicate, globose, rather flattened; sculpture

no costulation on the apical whorls, at the end of the sutural tube very fine close costulation commences, and increases very little in size forwards; colour whitish grey, some with a pink tint on the apex; spire low, apex rounded; suture moderately impressed, the tube long; whorls 4, the last swollen slightly, narrowly constricted and swelling again towards the aperture; aperture oval horizontally; peristome double, solid, inner sharply reflected, forming a broad margin viewed on the side: operculum black, smooth, spiral structure not seen in front, better seen at back, which is highly polished and with a central nipple.

Size: maj. diam. 7·0; axis 2·5 mm.

Alycæus globulus, G.-A. (Plate CXLIV. figs. 4, 4 *a*, 4 *b*.) No. 2486 B.M. Coll.

Godwin-Austen, J. A. S. B. vol. xliii. pt. 2 (1874), p. 147, pl. iii. figs. 4, 4 *a*, 4 *b*.

Theobald, Cat. Supp. p. 39.

G. Nevill, Hand-l. i. 1878, p. 291.

Von Möllendorff, Nachrbl. Deutsch. Malak. Ges. 1897, p. 150: Sec. *Charax*.

*Original description*:—"Shell moderately umbilicated, globosely turbinate, white, finely costulated on the shell of the first whorl, becoming gradually smooth thence to the apex; spire conoid, apex flat, rounded; whorls 4, flat, the last moderately swollen, then sharply constricted and again enlarged by a ridge from which emanate four minor longitudinal ridges on the expanded portion of the peristome; constriction narrow close to sutural tube, this is moderate in length and about equal to the distance of its base to lip; aperture much expanded, oblique, round, angulate above, waved on the outer margin and channelled within: the outer lip of peristome thin, slightly recurved on the inner lower margin. Operculum black, multispiral, concave.

"Major diam. 0·20", minor 0·16"; alt. 0·1".

"*Habitat.* Phunggum, a Naga village at head of the Lanier Valley, at 5000 feet, where it is abundant.

"It is near the *crispatus*-form described in my last paper. Its larger globose form, long sutural tube, and more open umbilicus mark it as distinct."

Alycæus inflatus, G.-A. (Plate CXLIV. figs. 1 *b*, 1 *c*, 1 *d*.) No. 2536 B.M. Type.

Godwin-Austen, J. A. S. B. 1874, xliii. pt. 2, p. 146, pl. iii. figs. 1–1 *d*.

*Original description*:—"Shell depressedly turbinate, solid, pale ochreous horny, moderately umbilicated, smooth, *finely sculptured on the swollen portion of the last whorl adjacent to the sutural tube.* Spire conoid, apex blunt; suture impressed; whorls $4\frac{1}{2}$, the last very much swollen for the size of the shell; constriction *smooth*,

*very short*; sutural tube moderate; aperture oblique, circular; peristome double, solid, united, and reflected; operculum concave, black, its position far forward at the very edge of the aperture.

"Maj. diam. 4·5; alt. axis 2·2 mm.

"*Habitat.* I first noticed this shell in the collection of Mr. F. Stoliczka, who kindly allowed me to take it for figuring; it had been found in Assam, but its exact locality was unknown. In the winter of 1872–73 I was fortunate to find it myself in the Naga Hills under Japvo Peak and again at Yémi, Phúnggum, and Gaziphimi at the head of the Lanier River on the main water-shed.

"This shell in many respects assimilates to *A. conicus*, mihi, but is more openly umbilicated; in another direction it has the character of the subgenus *Dioryx*, viz. in form of mouth, the short constriction, and position of operculum close to the edge of the aperture."

I got *inflatus*, No. 2537 B.M., from the head of the Lanier River, Lahupa Naga Hills.

The three forms above mentioned on closer examination are easily distinguished one from the other. The original description is of the Japvo Peak species, true *inflatus*, pl. iii. figs. 1 *b*, 1 *c*, 1 *d*; figs. 1, 1 *a*, is Stoliczka's Assam (No. 969. 06.1.1 B.M.); this must be considered a variety, the costulation on the swollen portion of the whorl being much stronger and distance from the aperture much greater. The Ghaziphimi, N.E. Munipur, species I separate from *inflatus* as *A. subinflatus* No. 2489 B.M., the differences being describable.

Alycæus inflatus, G.-A., var. (Plate CXLIV. figs. 1, 1 *a*.) Assam.

Alycæus kezamaensis, n. sp. (Plate CXLIX. fig. 1.)

*Locality.* Kezama, Anghami-Naga Hills, No. 2556 B.M. Coll. (*Godwin-Austen*).

Shell globosely conoid, umbilicated; sculpture distant, very regular costulation, at sutural tube fine and very close; colour dark ochraceous; spire conoid with flat sides; suture slightly impressed; whorls 4, not very rounded, the last viewed from above expanding slightly forwards, constriction close to base of sutural tube, then swelling slightly between it and the peristome; aperture semiovate, angulate near suture; peristome double, somewhat thickened and sinuate above.

Size: maj. diam. 2·9; alt. axis 1·0 mm.

A very small species with no very salient characters allied to *asaluensis*. A smaller shell, more globose, and differs in the form of the aperture.

Alycæus khasiacus, G.-A., No. 2651 B.M. Coll.

This was obtained at Asalu, and agrees with Khasi Hill specimens.

Alycæus lahupaensis, n. sp. (Plate CXLI. figs. 3, 3 *a*.)

*Locality*. Gaziphimi, Lahupa Naga Hills, Munipur (*Godwin-Austen*). No. 2656 B.M. Type.

Shell globosely turbinate, umbilicus fairly open; sculpture at the sutural tube is fairly strong, regular, close costulation, becoming gradually finer towards the apical whorls; colour whitish or very pale ochraceous; spire depressedly conoid; suture impressed, the sutural tube short; whorls $4\frac{1}{2}$, well rounded, last crossed by a low ridge between the aperture and sutural tube; aperture ovate, angulated above, rounded below; peristome very solid, double, very slight crenulation visible on the outer margin but not inside the aperture; columellar margin nearly vertical, sinuate.

Size: maj. diam. 4·0; alt. axis 1·8 mm.

At a first glance, this shell might be taken for *A. khasiacus*, G.-A., J. A. S. B. vol. xl. 1871, pl. iii. fig. 4, the type of which is from the Garo boundary of the Khasi Hills; but on placing the two side by side, there is considerable difference in its size, longer sutural tube, aperture not so circular and the peristome larger, so much more thickened.

An *Alycæus*, unfortunately a single specimen and imperfect, was sent to Colonel Beddome by Mr. Muspratt, of the Assam Police, from the Naga Hills, probably the Eastern. It appears to be a new species and somewhat similar in appearance to *A. lahupaensis*, the sutural tube being short, but it is much larger, being 5·3 mm. in major diameter. No. 287, Bedd. Coll. B.M.

Alycæus levis, n. sp. (Plate CXXXVIII. figs. 3, 3 *a*.)

*Locality*. Munipur, No. 2631 B.M. Coll. (*Godwin-Austen*).

Shell depressedly globose, umbilicus open; sculpture: shell a good deal worn, but very fine close costulation next the sutural tube; colour bleached; spire conical, depressed; apex rounded; suture moderately impressed, sutural tube long; whorls $4\frac{1}{2}$, slight, constriction in front of tube and then slightly swelling again; aperture circular; peristome double, simple, much thickened; columellar margin rounded; operculum black.

Size: maj. diam. 6·0; alt. axis 2·7 mm.

It is unfortunate that only one specimen occurred among the shells I collected in Munipur, and the exact locality was not recorded. It is in form exceedingly like a very large *Alycæus* from Burma, *A. magnus*, but about half as small.

Alycæus logtakensis, n. sp. (Plate CLV. fig. 6.)

*Locality*. Logtak Lake, Munipur (No. 2639 B.M. Coll.), on a low hill near the northern shore.

Shell closely umbilicated, globosely pyramidal; sculpture; distant, strong costulation on the upper whorls, close, well raised, and stronger at the sutural tube, and finely so anterior to it; colour whitish; spire high conical, apex rather pointed, suture moderately

impressed, the sutural tube fairly long; whorls 4, the last moderately swollen and slightly constricted in front of the sutural tube; aperture oval, strongly angulate above near suture, rounded on outer margin; peristome double, very thick as viewed from the side, well reflected, the outer somewhat protruded and angulate on the lower margin.

Size: maj. diam. 3·4; alt. axis 1·6 mm.

ALYCÆUS MAGNUS, G.-A. (Plate CXXXVIII. figs. 1, 1*a*.)

P. Z. S. 1893, p. 594. Type No. 1480 B.M.

*Locality.* Naga Hills, 150 miles eastward of Kohima (*Muspratt*, in coll. Col. Beddome).

*Original description*:—"Shell globosely turbinate, rather closely umbilicated, thick; sculpture: fine regular costulation next the sutural tube, becoming finer and more irregular on the apical whorls; colour, specimen bleached; spire conoid, rounded, apex blunt; suture moderately impressed, the sutural tube long and well developed; whorls 5, the last much swollen, the constriction near the base of the sutural tube slightly swelling towards the aperture; aperture oblique, circular, with a slight angulation above; peristome double, continuous, strong, slightly expanded and reflected, the inner with a flange on the umbilical margin.

"Size: maj. diam. 11·0, min. diam. 8·8; alt. axis 5·25 mm.

"Two specimens of this shell have been submitted to me by Col. Beddome, neither of them in the best state of preservation. It is a giant, yet modified, form of *A. nagaensis*, from Asalu, but it is more closely umbilicated and the costulation, for its greater size, is much finer; it is also more globose and more rounded at the apex."

Six typical specimens were found by me when going through Col. Beddome's Collection, out of which I have selected two for the B.M. Collection (No. 288 Bedd. Coll. 12.iv.16); the type figured in my own collection was given to me by Col. Beddome.

ALYCÆUS MULTIRUGOSUS, G.-A. (Plate CXLIV. figs. 7, 7*a*.) No. 2485 B.M. Type.

Godwin-Austen, J. A. S. B. 1874, xliii. pt. 2, p. 149, pl. iii. figs. 7, 7 *a*.

Shell depressedly subturbinate, rather openly umbilicated, translucent, pale corneous, smooth glistening surface, very minute ribbing near sutural tube. Spire flatly conoid; whorls 4, flat, the last very little swollen, constricted and enlarged again towards the aperture into a zigzag-shaped ridge or what might be described as three parallel and connected ridges. Sutural tube short. Aperture oblique, circular; peristome double, both continuous and the outer slightly reflected. Operculum......?

Major diam. 0·12″, minor diam. 0·08″; alt. 0·08″; sutural tube 0·037″.

*Habitat.* Hills at head of the Lanier River, Naga Hills, about 5–6000 feet, rare.

A close ally of *A. khasiacus*, mihi, but a much smaller shell; the many ridged area near constriction, however, is a wide departure from that form. A large var. of *A. khasiacus* occurred at Gaziphima and, as an instance of local variability in this genus, a few of the specimens have a slight tendency to a fimbriated peristome as in *A. crenatus*, mihi.

Alycæus muspratti, n. sp. Beddome MS. (Plate CXLVIII. fig. 1.)

*Locality.* Eastern Naga. Type figured. No. 273. 12.iv.16 Bedd. Coll. B.M. (*Muspratt*).

Shell depressedly conoid, openly umbilicated; sculpture smooth on first two whorls, then very strong, regular, somewhat close costulation, gradually more distant up to the end of the sutural tube where it suddenly becomes much finer, as far as the base of the tube, next which costæ are stronger, very fine striæ cross the inflated portion behind the peristome; colour stony white; spire low, apex blunt; suture impressed, the sutural tube long; whorls 4, somewhat flattened, last rounded and swollen next the sutural tube, then sharply constricted, and swelling into a well marked ridge, ending in a slight depression behind the lip; aperture irregularly oval horizontally; peristome viewed on side very thick, broad, expanded forward, sinuate, of many layers, in front crenulated, a strong notch at the sutural margin, 4 shallower on the outer and lower, columellar margin curving downwards; operculum burnt sienna, of many whorls; suture well seen.

Size: maj. diam. 4·2; alt. axis 2·0 mm.

This very beautiful species had been named by Colonel Beddome but there was no description with it, and I cannot find that he ever published one; Mr. G. K. Gude kindly assisted me to find it. A very large number of examples were in the collection, so it must be extremely abundant wherever Mr. Muspratt, of the Assam Police, discovered it.

Alycæus nagaensis, G.-A. (Plate CXLIII. figs. 2, 2 *a*, 2 *b*.) No. 2615 B.M. Type.

*Alycæus ingrami*, var. *nagaensis*, Godwin-Austen, J. A. S. B. xl. pt. 2, 1871, pl. v. figs. 2, 2 *a*, 2 *b*; G. Nevill, Hand-list, p. 292; Theobald, Cat. Supp. p. 40; Godwin-Austen, J. A. S. B. xliii. pt. 2, 1874, p. 150.

*Original description*:—"Shell depressedly globose, openly umbilicated, thick, slightly translucent, white, generally covered with a thin muddy coating, finely and sharply costulated throughout. Spire depressedly conoid, apex blunt, suture impressed; whorls 4, rounded, the last much swollen; constriction close to the base of sutural tube, slightly swelling again towards the mouth, quite smooth; sutural tube very long and thin. Aperture oblique,

circular; peristome double, both lips close and slightly expanded. Operculum black, smooth and concave in front, convex at back, with a central boss.

"Major diam. 0·32″, minor diam. 0·27″; alt. 0·29″; diam. of aperture 0·15″; sutural tube 0·15″.

"*Habitat.* Neighbourhood of Asálú, rather local in its distribution, but then abundant.

"Its well costulated surface distinguishes it from the preceding variety of *A. ingrami.*"

In 1874 I gave the following localities in the Naga Hills and Munipur; Kezakenomih, Kopamedza, Prowi, Laisen, and Nongmaiching.

*A. nagaensis*, small variety, Eastern Naga Hills (No. 286. 12.iv.16 Bedd. Coll. B.M.), is smaller than the type. Four specimens were collected by Mr. Muspratt.

ALYCÆUS NOWGONGENSIS, n. sp. (Plate CXXXVII. figs. 4, 4 *a*, 4 *b*.)

*Locality.* Koliaghur or Koliahur, Nowgong District, Assam (No. 2682 B.M.) (*Godwin-Austen*).

Shell rather openly umbilicated, depressedly turbinate; sculpture: fine regular costulation, terminates short of the length of the sutural tube, succeeded by well-marked distant ribs; colour white, bleached; spire conic, somewhat depressed; suture well impressed, sutural tube moderately long; whorls 4, well rounded, the last constricted close to base of sutural tube, then slightly swollen diagonally forward to the peristome; aperture circular, simple, slightly angulate at upper outer angle; peristome double, the outer reflected and spreading outwards.

Size: maj. diam. 3·0; alt. axis 1·4 mm.

In the form of the inflation in front of the constriction this species recalls *A. diagonius*, but its shape is quite different and it is much more openly umbilicated. I found this single specimen on the low granite hill of Koliaghur in the ruins of an old temple. The Brahmaputra washes the base of the hill, a terminal spur from the Lhota Naga Hills on the south.

ALYCÆUS PEILEI, Preston.

*Alycæus* (*Charax*) *peilei*, Preston, Proc. Malac. Soc. vol. xi. p. 22, March 1914; with photographed figure.

*Original description*:—"Shell irregularly discoidal, moderately depressed, white; whorls 4, the last gibbous, thin, strongly strangulated, or again becoming gibbous just behind the labrum, sculptured with fine, somewhat distant, transverse, arcuate striæ, which become closely crowded on the last whorl; suture rather deeply impressed; tube about 3 mm. in length; umbilicus rather widely ovate, deep; columella obliquely curved; labrum continuous, double above, treble below, erect, sinuous, having two notches, one

broad in front, the other narrower above; aperture irregularly subcircular.

Alt. 4, diam. maj. 6·5, min. 5·5 mm.; aperture: alt. 1·5, diam. 1·75 mm.

*Hab.* Naga Hills.

ALYCÆUS PUSILLUS, G.-A.

This was found at Asalu, North Cachar. No. 2772 B.M. Coll.

ALYCÆUS SUBCULMEN, G.-A.

Godwin-Austen, Moll. Ind. 1897, vol. ii. pt. 7, p. 4, pl. lxiii. figs. 4, 4 *a*.

P. Z. S. 20th June, 1893, p. 593.

Typical specimen No. 2687 B.M. Coll.

ALYCÆUS SCULPTILIS, Bs., var. G. Nevill.

G. Nevill, Hand-l. i. 1878, pp. 292–3.

*Localities.* 20 sp., Naga (*A. W. Chennell*); 20 sp., Khasi Hills (*Godwin-Austen*).

It is doubtful what these can be; they were not included among those which came from Calcutta. I hear (October 1914) they cannot be found in the Museum, owing to shifting of collections.

ALYCÆUS SCULPTURUS, G.-A. (Plate CXLV. figs. 6, 6 *a*, 6 *b*.) No. 2666 B.M. Type.

Godwin-Austen, J. A. S. B. xliv. pt. 2, 1875, p. 8, pl. iv. fig. 2; v. Möllendorff, Nachrbl. Deutsch. Malak. Ges. 1897, p. 148, in subgenus *Orthalycæus*, Pfr.

*Original description*:—"Shell closely umbilicated, turbinate, horny or grey, with distant well-marked costulation on the upper whorls, smooth below, finely ribbed on swollen part of the whorl, still more finely on the constricted portion; spire subconoid; whorls 4, the last slightly swollen, then constricted and slightly swelling again towards the peristome, which is longitudinally undulated; sutural tube moderate; aperture oblique, waved; peristome thickened, expanded a little, double, with four deep undulations on the outer margin and one less developed on the lower, the first undulation forming a deep notch on the peristome near its junction with the last whorl. Operculum as in *A. crispatus* mihi.

* The type of this species is in the Natural History Museum, and I have been able to make a drawing of it. Mr. Preston tells me it is named after a collector, who has recently been in Assam. It is allied to *A. stoliczkii*, mihi, in the form of the peristome, but is more openly umbilicated, and the sculpture is very different—not by any means so strong. I would thus describe it:—"Strong costulation next the base of the sutural tube extending forwards as far as the constriction, backwards it becomes rapidly finer, long before the end of the sutural tube is reached, it is close and beautifully regular on the rest of the shell, and within the umbilicus."

"Major diam. 0·14, minor diam. 0·10, alt. 0·08 inch.

"*Hab.* Obtained by me on the hill-ranges from near Tellizo Peak to the eastward and on Mungching Hill in Manipur. Abundant.

"This species is very close to *A. crispatus*, G.-A., from the Khasi and Jaintia Hills, J. A. S. B. xl. pl. iv. fig. 1, but is a much more closely wound shell—a character which, when a large series of the two were placed side by side, was found to be constant; and this, with the absence of the ridge on the constriction, marks it as distinct. *A. sculptilis*, Bs., originally described from Burma—of this I collected identical specimens in Munipur—is another form near *A. sculpturus*, but has no crenulation of the peristome and is plain and ridgeless on the constriction; the three forms pass into one another."

The above reference to *A. sculptilis* was unfortunately made under some misconception of the form of the species, the Munipur specimens referred to are described as *A. tanghali*.

Typical *A. sculptilis* seen since in Blanford's collection from Thyatmyo, Pegu, has very fine serration within the aperture (see Pl. CLV. fig. 8).

The type-shell figured was from Sikhami in the Lahupa Naga Hills, in the N.E. Frontier of Munipur. No. 2666 B.M.

It was found also at the following places:—

No. 2670 B.M., Kezakenomih, Naga Hills. No. 2647 B.M., Gaziphimih, Lahupa Naga. No. 2667 B.M., Munching, Munipur. No. 2668 B.M., Laisen, Munipur. No. 2669 B.M., Nongmaiching, Munipur.

Alycæus stoliczkii, G.-A. (Plate CXLIV. figs. 3, 3 *a*, 3 *b*.)

Godwin-Austen, J. A. S. B. xliii. pt. 2, 1874, p. 147, pl. iii. figs. 3, 3 *a*, 3 *b*.

*Localities.* No. 2622 B.M. Type, Anghami-Naga Hills, probably near Kohima. No. 2623 B.M., Angaoluo Peak, 7000 ft., Naga Hills. *stoliczkii* var., No. 2624 B.M., Kohima. Smaller, major diam. only 6 mm., finer sculpture. No. 2625. B.M., Lhota Naga Hills. Aperture more circular, crenulation indistinct.

*Original description*:—"Shell globosely turbinate, thick, pale horny, finely and closely ribbed from the swell of the first whorl as far back as the end of the sutural tube, thence to the apex distantly and finely costulated, narrowly umbilicated; spire conoid, apex blunt; suture well impressed; whorls $4\frac{1}{2}$, rounded, the last swollen, then sharply constricted close to the origin of the sutural tube, again swelling and expanding to the mouth; constriction smooth, with a few distant lines of costulation. The sutural tube peculiarly long. Aperture oblique, circular; peristome double, outer lip small, the inner much produced and expanded into two broad, shallow channels on the inside of the outer margin, separated by a V-shaped thickening of the same (see fig. 3 *b*). Operculum black, concave, of the usual multispiral form.

"Major diam. 0·31–0·28″, minor 0·24–0·20″; alt. 0·17–0·15″; diam. ap. 0·12″; sutural tube 0·15″.

"*Habitat.* Two specimens were obtained for me by Mr. Belletty on Angaoluo Peak, Naga Hills, at 7000 ft., during the field-season of 1872–73. I found it again further to the east at Kezakenomih, and at the head of the Lanier River at about 5000 ft., where the specimens were much larger. It comes near to the forms of *A. ingrami*, W. Blf., var., pls. iv. & v., J. A. S. B. vol. xl. pt. 2, 1871, from the same range of mountains, but its tumid shape, and particularly the very produced aperture, render it a very distinct and well-marked species. I have named it after that very accomplished conchologist and malacologist, Dr. F. Stoliczka of the Geological Survey of India."

A single specimen No. 2758 B.M. from Teria Ghat is very near this species, differing in being smaller, major diam. 4·75 mm., with a flatter spire, and costulation adjacent to the sutural tube very much finer, not so closely wound.

Alycæus serratus, G.-A. (Plate CXLIV. figs. 6, 6 *a*, 6 *b*.)
No. 2487 B.M. Type.

Godwin-Austen, J. A. S. B. 1874, xliii. pt. 2, p. 148, pl. iii. figs. 5, 5 *a*, 5 *b*; Theobald, Cat. Supp. 1876, p. 40; G. Nevill, Hand-list, i. 1878, p. 291.

*Original description*:—"Shell very closely umbilicated, turbinate, rather thin, pale corneous or dark brown, finely costulated on tumid portion of the last whorl; rest of shell smooth, with shining surface; suture moderately impressed. Spire conoid, apex pointed. Whorls 4, rounded, the last very slightly tumid, constricted and enlarged into a low, recurved ridge. Sutural tube moderate. Aperture subvertical, circular, very finely notched on lower and outer margin; peristome double, thick, the outer reflected on the inner margin. Operculum thin, pale horny, flat in front.

"Major diam. 0·10″, minor diam. 0·09″; alt. 0·9″.

"*Habitat.* Laisen Trigl. Station, Munipur Hills. Rare, some eight specimens only having been found. In the thickened rounded form of the peristome this species assimilates to *A. conicus*, but the minute notches on the inner margin are peculiar and unlike what is seen in any form I am acquainted with. It seems intermediate between the above and *A. diagonius*."

Alycæus subinflatus, n. sp. (Plate CLIV. figs. 8, 8 *a*.)
No. 2489 B.M. Type.

*Locality.* Gaziphimi, Lahupa Naga Hills, N.E. Munipur.

Shell globosely conoid; sculpture: indistinct subdued costulation on upper whorls, apex distinctly striate spirally, close, regular, rather fine costulation continuous with the sutural tube; colour with pinkish tinge, red on the apex; spire rather high; suture impressed; whorls 4, tumid and well rounded; sutural tube long, constriction near its base and distance to aperture short, with a

very slight swelling ; aperture oval, subangulate above ; peristome solid and double on the outer margin, and well reflected but very thin on the columellar side.

Size : maj. diam. 4·5 ; alt. axis 2·2 mm.

This is the species which I included in my description of *A. inflatus* from Japvo Peak in the Anghami-Naga Hills. It is an allied form, and on closer examination I consider should receive a name, as it is something more than a variety. Comparison of the figures shows this better than description.

ALYCÆUS STRIGATUS, G.-A.

Of this species obtained by Ferd. Stoliczka in Assam—the exact locality unknown—a single specimen was found at Nenglo near Asalu, North Cachar (No. 2770 B.M. Coll.).

ALYCÆUS TANGHALI, n. sp. (Plate CXXXVII. figs. 3, 3 *a*, 3 *b*.) No. 2671 B.M.

*Locality*. Munipur. Exact locality not recorded; somewhere on the northern side of the valley.

Shell globosely turbinate, umbilicus small; sculpture: close, rather strong costulation where sutural tube begins, gradually getting more distant towards the end, then becoming distant and well marked ; colour whitish, some covered with an earthy deposit; spire conical, rather high ; suture impressed, the sutural tube very long ; whorls 4, the last with very slight constriction in front of sutural tube and slightly swelling forward towards the aperture ; aperture nearly circular, somewhat angulate above; peristome double, protruding forward on the sutural margin, the inner slightly reflected ; columellar margin rounded.

Size: maj. diam. 3·5 ; alt. axis 2·0 mm.

I had thought this species to be *A. sculptilis*, Bs., until compared with that Burmese species. It is of quite a different shape, *sculptilis* being subangulate on the periphery and with a shorter sutural tube. I name it after Tanghal Major, of the Manipur Army, who represented the Raja when we were laying down the boundary between his territory and the Naga Hills in 1873.

ALYCÆUS THEOBALDI, W. Blf., var. DIYUNGENSIS, G.-A. (Plate CXXXVIII. fig. 4.)

*Locality*. Diyung Valley, north of Asalu, N. Cachar (No. 2546 B.M.) (*Godwin-Austen*).

Shell well umbilicated, depressedly turbinate ; sculpture : rather strong, regular, close costulation extending just beyond the end of the suture, the rest of shell smooth, finely striate, with very distant costulation ; colour ochraceous, some with a green tint; spire conic, depressed ; suture well impressed, the tube moderately long; whorls 4, rounded ; aperture circular, slightly angulate above ; peristome double, the outer, viewed from above, rather expanded ; columellar margin rounded.

Size: maj. diam. 4·2; alt. axis 2·0 mm.

This Diyung Valley species is a departure from *A. theobaldi* of the Khasi Hills in having the apex less high and conical, the suture more impressed, the shell more openly umbilicated; costulation next suture stronger. I collected a dozen specimens.

ALYCÆUS (DIORYX) URNULA, var. ANGHAMIENSIS. Type. No. 2530 G.-A. Coll. (Plate CLIII. figs. 6, 6 *a*.)

*Locality.* Japvo Peak, Naga Hills, 9890 ft. (*Godwin-Austen*).

Shell very globosely conoid, imperforate, with strong epidermis; sculpture smooth, with distant strong striation approaching irregular distant costulation; fine close costulation as far back as end of the sutural tube; colour pale sienna-brown, apex darker; spire subconic, low: apex blunt; suture impressed, the sutural tube very long; whorls 4, much rounded; aperture circular, vertical; peristome compactly double.

Size: maj. diam. 4·1; alt. axis 2·9 mm.

Other specimens were found in the Anghami-Naga Hills (No. 2529 B.M., figured on Plate CLIII. figs. 5, 5 *a*). This is very distinct from typical *D. urnula* in its globose, tumid shape. From the Lhota Naga Hills, there are five specimens (No. 2603 B.M.) which come very close to this variety, yet are not quite the same, and one is very large, 4·5 mm. in major diameter and 6 mm. in height.

ALYCÆUS (DIORYX) URNULA, var. PISUM. No. 2528 B.M.

*Locality.* Jatinga Valley, North Cachar.

Similar in every respect to the typical shells from Marangsip Peak in the South Jaintia Hills. One larger than the others is 4 mm. in major diameter.

ALYCÆUS (DIORYX) VARIUS, n. sp. (Plate CLVII. figs. 7, 7 *a*.) No. 2574 B.M.

*Locality.* Lhota Naga Hills (*A. Chennell*).

Shell turbinate, narrowly perforate; sculpture: transverse striation above, finely costulated next the sutural tube; colour bleached; spire rather high, apex fine: suture impressed, sutural tube long; whorls 4, rounded, slightly swollen near sutural tube, constriction near base of it and at some distance from the peristome, interval smooth and straight; aperture circular, subvertical; peristome double, solid, thickened on outer margin, not so on the columellar margin.

Size: maj. diam. 4·0; alt. axis 2·5 mm.

This is an interesting form, but unfortunately only one specimen was found. The long sutural tube and the short distance it is behind the peristome places it in *Dioryx*, but it differs very much in the umbilical region and in general shape.

ALYCÆUS (CYCLORYX) BURRAILENSIS, n. sp. (Plate CXLVII. figs. 6, 6 *a*.) No. 2591 B.M.

*Locality*. Japvo Peak, Naga Hills, 9890 ft. (*Godwin-Austen*).

Shell: perforation hidden, shell conoid; sculpture: very close, fine, and regular costulation; apex smooth; distant fine costulation between sutural tube and aperture; colour whitish, but often bright pale sienna, darker on the apex; spire high, conical, apex blunt; suture very impressed; whorls 4, strongly rounded; aperture circular; peristome double, slightly expanded on the outer margin, a slight flange covering the perforation; operculum pale ochraceous, multispiral, smooth, slightly concave.

Size: maj. diam. 2·8; alt. axis 1·8 mm.

Close to *A*. (*Cycloryx*) *mangutensis* of the Jaintia Hills, but differs in form of the spire, which is much broader and blunter than in that species.

Obtained also on the Munipur side of the Burrail, No. 2606 B.M.; and Angaoluo Peak, No. 2749 B.M.

This species is about the same size as *A. granum*, from Margarita at foot of the Eastern Naga Hills, found there by the late Mr. W. Doherty, is of more depressed form, it is much more openly umbilicate, and the close costulation coarser than in *granum*.

ALYCÆUS (CYCLORYX) KHUNHOENSIS, n. sp. (Plate CXLVII. fig. 8.) No. 2520 B.M.

*Locality*. Khunho Peak, Naga Hills (*Godwin-Austen*).

Shell elongately conoid, rimate, thin, transparent; sculpture closely and similarly costulated throughout, no closer near the short sutural tube, very unusual in the genus; apex smooth; colour pale pinkish, ochraceous on apical whorls; spire high, sides flat; suture impressed; whorls 4, very rounded, constriction close to sutural tube, flat and smooth thence to the aperture; aperture nearly circular, vertical; peristome simple, reflected; columellar margin rounded.

Size: maj. diam. 1·9; alt. axis 1·3 mm.

This is *Alycæus* (*Dioryx*) *graphicus*, W. Blf., var. *minor*, Godwin-Austen. (Plate CXLIV. figs. 9, 9 *a*.)

Godwin-Austen, J. A. S. B. xliii. pt. 2, 1874, pl. iii. figs. 8, 8 *a*.

*Original description*.—" This shell is much smaller than *graphicus* from the Khasi Hills, &c., and is longer in spire, with close costulation throughout.

" The differences, though persistent in Naga Hill specimens, are not sufficient to make the form distinct.

" Major diam. 0·10″, alt. 0·12″."

ALYCÆUS (CYCLORYX) GRAPHICUS, W. Blf., var. VARIABILIS.

Lhota Naga. No. 2607 B.M. (Plate CXLVI. fig. 4.)

This is another variety of *graphicus*. The costulation on tho

upper whorls is strong and rather distant, much closer and much stronger next the ovate sutural tube; about six to seven costæ between the tube and peristome, there are from 2 to 3 well marked costæ on the very slightly swollen part of the whorl. There are about a dozen examples, and from Piknui Hill, 2602 B.M., about 8.

ALYCÆUS (CYCLORYX) GRAPHICUS, W. Blf., var. DIHINGENSIS.

No. 2748 B.M. was found on Angaoluo Peak, Naga Hills, and one example, No. 295. 12.iv.16, occurred in Colonel Beddome's collection from the Naga Hills, exact locality not mentioned; as Mr. Muspratt was the collector it was probably somewhere on the eastern side.

ALYCÆUS (CYCLORYX) MULTICOSTULATUS, n. sp. (Plate CXLVII. fig. 7.) No. 2557 B.M.

*Locality.* Head of the Lanier River, Lahupa Naga Hills, N.E. Munipur.

Shell globosely turbinate, narrowly umbilicate; sculpture: very close, regular costulation, disappearing on the two apical whorls; colour white, with an ochraceous tint; spire high, pyramidal; apex rather fine; suture strongly impressed; whorls 5, rounded on sides, swollen; aperture circular; peristome double, both thin; columellar margin nearly vertical.

Size: maj. diam. 3·25; alt. axis 2·25 mm.

Comparing this with *A. granum*, it has for its size much closer costulation. It is more narrowly umbilicate than *A. burrailensis*, which is a much smaller shell.

ALYCÆUS (CYCLORYX) THOMPSONI, n. sp. (Plate CXLVI. figs. 3, 3 *a*.) No. 2550 B.M.

*Locality.* Munipur (*Godwin-Austen*).

Shell ovately globose, umbilicus concealed; sculpture: fine, regular, close costulations, six on the length of the sutural tube, *about seven between it and the peristome indistinct*; colour whitish; spire rather high, apex rather blunt; suture moderately impressed; whorls $4\frac{1}{2}$, sides convex; aperture circular, *with a flange close to the umbilicus and completely covering it*; peristome double, thickened, continuous.

Size: maj. diam. 3·8; alt. axis 2·5 mm.

I name this after Colonel Mowbray Thompson, one of the three survivors of the Cawnpur massacre; he was political agent in Munipur when I was surveying the country.

## 7. *Burma and Shan States* (*the Irravady and Salween Valleys*).

| | |
|---|---|
| *Alycæus anonymus*, G.-A., W. Blf. MS. | Pl. CXXXIX. figs. 1, 1 *a*. |
| *armillatus*, Bs. | Pl. CLI. figs. 3, 3 *a*. |
| *avæ*, W. Blf. | Pl. CLI. fig. 6. |
| *bifrons*, Theob. | Pl. CXXXIX. figs. 3, 3 *a*. |
| *cucullatus*, Theob. | Pl. CLV. fig. 5. |
| *davisi*, n. sp. | Pl. CXLVIII. figs. 9, 9 *a*. |
| (*Cyclorуx*) *difficilis*, n. sp. | Pl. CLV. figs. 2, 2 *a*. |
| *dohertyi*, G.-A. | Pl. LXIII. figs. 3, 3 *a*. |
| (*Dioryx*) *feddenianus*, Theob. | Pl. CLIII. fig. 12. |
| (*Cyclorуx*) *graphiarius*, n. sp. | Pl. CXLVI. figs. 7, 7 *a*. |
| *humilis*, W. Blf. | Pl. CLI. fig. 8. |
| *kengtungensis*, n. sp. | Pl. CXXXIX. figs. 6, 6 *a*. |
| *kurzianus*, Theob. & Stol. | Pl. CLI. figs. 7, 7 *a*. |
| *nattoungensis*, n. sp. | Pl. CLV. figs. 15, 15 *a*. |
| *notus*, n. sp. | Pl. CLV. fig. 12. |
| *ochraceus*, G.-A. | Pl. LXIII. figs. 7, 7 *a*, 7 *b*. |
| *omissus*, n. sp. | Pl. CLV. fig. 13. |
| (*Dioryx*) *pingoungensis*, G.-A. | Pl. CLIII. figs. 13, 13 *a*. |
| *rubinus*, G.-A. | Pl. LXIII. figs. 2, 2 *a*. |
| *sculptilis*, Bs. | Pl. CXXXIX. figs. 7, 7 *a*. / Pl. CLV. fig. 8. |
| *margarita*, Theob. MS. | |
| (*Cyclorуx*) *spratti*, G.-A. | Pl. CLI. figs. 10, 10 *a*. |
| (*Cyclorуx*) *tenellus*, n. sp. | Pl. CLV. figs. 3, 4, 4 *a*. |
| *umbonalis*, Bs. | Pl. XLIV. figs. 2–2 *c*. |
| *vulcani*, W. Blf. | Pl. CLI. figs. 5, 5 *a*. |
| *woodthorpi*, n. sp. | Pl. CLV. fig. 14. |

No. 7 comprises an enormous area, in which the *Alycæi* differ considerably from those on the west (previous Sections 1–6). Only the hills near the Irravadi below Mandalay above and up to Bamao may be said to have been collected in. In the Shan States collecting has been very desultory, the limestone formation of that part would yield a fine harvest of very interesting forms. Nothing is known of the mollusca of the hill country west of the Kyengdwen in the Chin and Lushai Hills, or northward at the head of that river. South we have but few from the Sittoung and Salween, by no means what might be expected to occur.

Alycæus anonymus, G.-A., W. Blf., MS. No. 67 B.M. Coll. (Plate CXXXIX. figs. 1, 1 *a*.)

*Locality*. Akouk-toung, Pegu: Type; also Thoudaung and Yenandoung, Pegu.

Shell turbinate, rather openly umbilicated; sculpture fine regular costulation throughout, gradually getting coarser near the sutural tube, finer and continued up to the peristome; colour very pale ochraceous; spire conoid. fairly high, sides flat; suture impressed; whorls 4, well rounded, slightly swelling for the length of

the sutural tube which is moderately long; aperture nearly circular, oblique; peristome double and much thickened, slightly reflected.

Size: maj. diam. 6·7; alt. axis 3·5 mm.

From Moditoung, Pegu, there is an *Alycæus* represented by five specimens. No. 182 of the Blanford Collection, which Blanford has named *A. scepticus.* It is similar in every way to his *A. anonymus*, except in the sculpture being finer and the umbilicus slightly more open, and can only be considered a variety.

Alycæus armillatus, Bs. (Plate CLI. figs. 3, 3 *a*.)

Benson, A. M. N. H. ser. 2, xvii. (1856), p. 227; Pfr. Mon. Pneum. ii. p. 37; W. Blanford, A. M. N. H. June 1864, p. 458, in sec. vi.; Hanley & Th. Conch. Ind. 1870, p. 38, pl. xciii. fig. 10; Theobald, Cat. Supp. p. 39; G. Nevill, Hand-l. 1878, p. 293, Thyetmyo, W. Blf.

Specimen figured No. 71, 1906.4.4, Type Blf. Coll., B.M.

Original description:—"*Testa umbilicata, depresso-turbinata, costulata; spira conoidea, sutura impressa, apice obtuso; anfractibus* $3\frac{1}{2}$ *convexis, ultimo ad latus inflato, confertius costulato, tum constricto, antice tumido, læviori, tubulo suturali brevi, ab apertura remoto, munito; apertura obliqua circulari, peristomate duplici, interno valde porrecto, continuo, margine simplici, extus striato, exteriori expanso, reflexiusculo; umbilico subaperto. Operculo —— ?*

"Diam. major 2, minor $1\frac{3}{4}$, axis $1\frac{1}{4}$ mill.

"*Hab.* ad Thyet-Mio cum præcedente.

"The exterior expanded peristome, forming a conspicuous collar round the porrect interior portion, is the most prominent character in this very minute species.

"The only specimen received is in a weathered condition, and so much bleached that the colour of the perfect shell cannot be ascertained.

"Five new forms have here been added to this curious restricted genus, which now contains nine species, three of which are Himalayan, one Cochin-Chinese, and one (*A. spiracellum*, A. & R.) from Borneo. The Ultra-Gangetic region must at present be considered the headquarters of the type."

Alycæus avæ, W. Blanford. (Plate CLI. fig. 6.)

J. A. S. B. xxxii. pt. 2 (1863), p. 323; H. & T. Conch. Ind. pl. 94. figs. 8, 9, 10; Theobald, Cat. Supp. 1876, p. 39; Nevill, Hand-l. i. 1878, p. 293.

Specimen figured No. 61, 1906.4.4, Type Blanford Coll., B.M.

*Original description*:—"Shell depressed, openly umbilicated, thin, closely costulated throughout, more strongly on the inflated portion of the last whorl, white or light amber in colour. Spire very depressly conoid, apex blunt, suture impressed. Whorls 4, the last very little inflated at the side, then moderately constricted, constriction rather long, swollen in the centre, indistinctly costulated. Sutural tube short, about $1\frac{1}{4}$ mm. in length. Aperture

circular, diagonal. Peristome thickened, double, external lip expanded, inner continuous and projecting slightly at the base. Operculum thin, horny, multispiral, very concave externally and convex within, wanting the central boss.

"Maj. diam. 3½, min. 3; alt. 2; diam. ap. 1 mm.

"*Hab.* The hills east of Mandalay and Ava.

"This species approaches *A. strangulatus,* Hutt., which is larger and more discoid."

ALYCÆUS BIFRONS, Theobald. (Plate CXXXIX. figs. 3, 3 *a*.)

Theobald, J. A. S. B. xxxix. 1870, p. 396, pl. xviii. fig. 1; id. Cat. Supp. p. 39, Upper Salween Valley; Nevill, Hand-l. 1878, p. 293, no. 33, 6 sp., Shan States; Hanley & Theob. Conch. Ind. p. 38, pl. xciii. figs. 1, 4.

Specimen figured No. 20. 1906.5.5, Blanford Coll., B.M. (*Fedden*).

Original description:—"*Testa perspective umbilicata, depresse conoidea, translucente, cornea, apice rubello; spira elevatiuscula, sutura impressa: anfractibus quatuor, rotundis, juxta stricturam regulariter et confertim striato costulatis, reliqua parte aliquando fere lævigatis, aliquando levissime striatis. Strictura glabra, longa, fere quartam partem ult. anfractus æquante, duabus costis fortissimis munita, quarum posterior paulo robustior et anteriore longior est, tubulo suturali tenuissimo, adpresso, quartam peripheriæ æquante; apertura ampla, circulari sensim deflecta; perist. duplici, albido, labio adnato angustissimo, labro infra modice incurvato.*

"Diam. maj. 20, min. 15; alt. 10 unc.

"*Habitat.* Shan States."

ALYCÆUS CUCULLATUS, Theobald. (Plate CLV. fig. 5.)

Theobald, J. A. S. B. xxxix. pt. 2, 1870, p. 396, pl. xviii. fig. 2; Hanley & Theob. Conch. Ind. 1870, p. 39, pl. xcvi. figs. 1, 4; Theobald, Cat. Supp. p. 39.

Specimen figured No. 19. 1906.5.5, Blanford Coll., B.M. (*Fedden*).

Original description:—"*Testa umbilicata, depresse subdiscoidea, rubente cornea, transversim striata, juxta suturam fortioribus sive costulis filiformibus confertissime ornata, apice glabro, rufescente, elevatiusculo; anfractibus quatuor, convexis; tubulo suturali modico, quartam peripheriæ vix æquante; strictura brevi, lævigata, striis nonnullis costiformibus ad basin et costa crassa transversa notata. Apertura parum obliqua, subrotundata, fere soluta, labro externe modice expanso, lamellose undulato, ad marginem paulo incrassato, 5-inciso, lamella supera maxime producta; labro simplici, paulo arcuato, supra vix adnato; operculo corneo, margine elevato nucleoque centrali parum excavato.*

"Diam. maj. 21, diam. min. 20; alt. 21 unc.

"*Habitat.* Shan States."

This is a remarkably fine species with the crenulated lip of *A. plectocheilus* much exaggerated.

ALYCEUS DAVISI, n. sp. (Plate CXLVIII. figs. 9, 9 *a*.)

No. 1630 B.M. (*Colonel W. T. Woodthorpe, R.E.*).

Shell depressedly globose, well umbilicated; sculpture fine throughout, even next the sutural tube, first three or four liræ strong and distant, epidermis covers the surface which peels off in places; colour dull umber; spire low, apex flatly convex; suture well impressed, sutural tube long; whorls 4, the last very tumid, close, and in front of the constriction there is a well-defined ridge across the whorl, below it is close to the reflected peristome; aperture horizontally oval, oblique, subangulate above; peristome double, crenulated, four distinct notches, the upper on the upper margin, rounded on the columellar margin; operculum pale in colour, closely spiral with a small central depression.

Size: maj. diam. 5·3; alt. axis 2·1 mm.

Four specimens represent the species, they were obtained by Col. Woodthorpe on the expedition to define the Siam and Shan Boundary in 1894/5. I name it after Captain, now Lt.-Colonel H. B. Davis, commanding Oxfordshire and Buckinghamshire (52nd Lt. Infantry) Regiment, who was attached to the party.

ALYCÆUS DOHERTYI, G.-A.

Moll. Ind. vol. ii. 1897, p. 3, pl. lxiii. figs. 3, 3 *a*.

*Locality*. Momeit.

ALYCÆUS HUMILIS, W. Blanford. (69 *a* Coll. Blf. & B.M.) (Plate CLI. fig. 8.)

W. T. Blanford, J. A. S. B. xxxi. pt. 2, 1862, p. 136.

Original description:—"*Testa aperte umbilicata, turbinato-depressa, lævis, rubello-succinea, ad apicem sanguinea. Spira conoidea, apice obtusula, sutura profunda. Anfr.* $3\frac{1}{2}$, *rotundati, ultimus ad latus mediocriter inflatus et confertim costulatus, tum constrictus, versus aperturam breviter descendens. Strictura glabra, longa, antice tumidior. Tubulum suturale breve* $\frac{1}{6}$ *peripheriæ subæquans. Apertura obliqua, circularis; peristoma duplex; externo retrorelicto, interno continuo, porrecto, fere soluto. Operculum corneum, multispirum, externe concavum.*

"Diam. major $2\frac{1}{2}$, minor 2; alt. $1\frac{1}{2}$ mm.

"*Hab.* ad Akouktoung ad ripas fluminis Irrawaddi, in provincia Burmana Pegu.

"A solitary specimen of this species, slightly weathered and showing more sculpture than usual, was found by me in April 1861, close to Myanoung on the banks of the Irrawaddy *. With it I found a few other shells, amongst them a small variety of *Bulimus cœnopictus*, Hutt., and as this shell is not known to

* [This with many other typical species is in the Blanford Coll., and I have compared it with the Akouktoung specimens. I consider it to be *humilis*, although it does show some costulation posterior to the point of the sutural tube.]

inhabit Pegu, but has since occurred to me in the neighbourhood of Ava, I was inclined to suppose that *A. humilis* was also derived from that neighbourhood. Lately, however, during a hurried search at Akouktoung, I had the good fortune to find some living specimens of what, I have little doubt, is the same species as that which I first obtained, the only difference being the absence of any sculpture except on the tumid portion of the last whorl. From these specimens the above description has been corrected.

"*A. humilis* resembles somewhat the minute *A. armillatus*, B., but differs in the very much greater distance to which the strongly marked costulation upon the tumid portion of the last whorl is carried back from the constriction, the distance being in both species proportional to the length of the sutural tube [which is shown in fig. 8, Plate CLI.]. *A. humilis* is further distinguished by its longer constriction, by the descent of the mouth, and the greater tumidity of the last whorl. The colour, as in many *Alycæi*, is probably not quite constant, some specimens being white and translucent.

"With *A. humilis* at Myanoung I found a single broken specimen of another *Alycæus* [no doubt *vulcani*, W. T. B. (No. 50, 1906.4.4, Coll. Blf. & B.M.], which resembles the singular little Darjiling *A. plectocheilus* in the form of the peristome. The specimen being imperfect and weathered, I delay publishing a description of it in the hopes of succeeding in obtaining better specimens before doing so."

Alycæus kengtungensis, n. sp. (Plate CXXXIX. figs. 6, 6 *a*.)

*Locality*. Kengtung, Shan Frontier. No. 3037 G.-A. Coll. (*Colonel R. Woodthorpe, R.E.*).

Shell somewhat depressedly turbinate and umbilicated; sculpture: fine and rather close costulation on the upper whorls, much stronger next the sutural tube, and near the base of this peculiarly distant costæ very strong; colour white; spire conoid; suture impressed, sutural tube long; whorls 4, the last swollen, next sutural tube sharply constricted, then suddenly expanding into a rounded ridge crossing the whorl crescentically and expanding gradually forwards to the peristome; aperture oblique, horizontally oval, subangular above; peristome double, simple.

Size: maj. diam. 5·25; alt. axis 2·4 mm.

Only one specimen occurred among the shells collected by my old assistant, but the characters of *Alycæi* are so distinct, and such being the case in this instance I do not hesitate to describe it.

Alycæus kurzianus, Theobald & Stoliczka. (Plate CLI. figs. 7, 7 *a*.)

Theobald, J. A. S. B. xli. pt. 2 (1872), p. 330, pl. xi. fig. 2; id. Cat. Supp. 1876, p. 40; G. Nevill, Hand-list, 1878, p. 293.

6 Nattoung, West Prome (type) (*coll. W. Theobald*), 1 Pegu (*coll. Dr. Kurz*).

Specimen figured is in B.M. Coll. No. 2700, received from Stoliczka.

Original description :—" A. *testa subglobose conoidea, late umbilicata, pallide rufescente; anfractibus* 4, *valde convexis, sublævigata, transversim distanter obsolete costellatis, ultimo anfractu medio ambitus modice inflato, confertim costulato, tum valde constricto lævigatoque, in constrictione costa obtusa transversa instructo, rursusque expansiusculo atque paulo deflexo; apertura magna, obliqua, subrotundata, supra obtuse angulata, infra anguste canaliculata; peristomate modice incrassato, duplici, externo paulum expanso, labro interno plicatulo, labio sublævigato.*

" Diam. major specim. maximi 3·5, minor 3; alt. 2·7 mm.

" *Hab.* Nattoung in provincia Barmana, Prome dicta.

" The peculiarly formed aperture with the lower canal and its internal plication on the outer lip readily distinguish this species from *A. polygonoma*, which besides differs by more rounded and higher whorls. Mr. Kurz brought some years ago a specimen of this interesting species from Pegu; more recently Mr. Theobald collected it near Nattoung in the Western Prome district. The measurements above given are those of one of the largest specimens."

Alycæus nattoungensis, n. sp. (Plate CLV. figs. 15, 15 *a*.)

G. Nevill, Hand-list, p. 291, no. 8.

*Locality.* Nattoung Hills—a single specimen.

Shell conoid, base rather flat; sculpture strong well-defined costulation next the sutural tube, succeeded by fine distant and irregular; colour whitish, apex pinkish; spire fairly high; suture impressed, the sutural tube long; whorls $3\frac{1}{2}$, rounded, the last scarcely constricted close to the sutural tube, thence very flat to the aperture; aperture oval, subvertical; peristome is reflected, not double, but it is not quite fully developed.

Size: maj. diam. 2·5; alt. axis 1·1 mm.

This species in its small size and general form is like *A. pusillus*, G.-A., of the Jaintia Hills, but a close examination shows marked departure, seen particularly well, when viewed from above, in the very short sutural tube of *A. pusillus*—the very short costulated portion of the whorl and its smooth glossy surface, and generally flatter apex.

Theobald & Stoliczka (Journal A. S. B. 1872, p. 330), under genus *Alycæus*, say :—" Of this genus several species were found which were previously only known to occur in Sikkim and in the Khasi and Garo Hills. *A. pusillus* (see above) was met with at Nattoung in the Mendon district, Pegu. *A. urnula* and a small variety of *A. ingrami* at Maii in the Arakan hills: *A. crispatus* (= *ataranensis*, n. sp., see p. 426) at Maianoung and near Moulmein; at this last-named locality also occurred a large

red-lipped variety of *A. urnula* (*Dioryx labrirubidum*, see p. 430) and several specimens of *A. richthofeni*. The shells slightly vary in the height of the spire, but all are of exactly the same character."

This supposed extension of Burmese species to the N.E. Himalaya and Khasi Hills is not established, the *D. urnula* mentioned is probably not like the type.

ALYCÆUS NOTUS, n. sp. (Plate CLV. fig. 12.)

*Locality*. Fort Stedman, Burma. No. 3065 G.-A. Coll., B.M. (*Colonel R. Woodthorpe*).

Shell umbilicated, depressedly conoid, rather solid; sculpture on upper whorls fine very close costulation, becoming more distant as the end of the sutural tube is reached, it is then particularly fine and close, smooth behind aperture; colour stony white, some have a pink apex; spire low, apex blunt; suture impressed, the sutural tube rather short; whorls 4, rounded, constriction slight near base of sutural tube, then swelling very slightly forward to the peristome; aperture ovately circular; peristome double, thick, inner continuous, plain, outer reflected; operculum closely spiral, brown.

Size: maj. diam. 3·0; alt. axis 1·5 mm.

Like *armillatus*, but much larger.

ALYCÆUS OCHRACEUS, G.-A.

Moll. Ind. vol. ii. 1897, p. 3, pl. lxiii. figs. 7, 7 *a*, 7 *b*.

Ruby Mines Dist., Upper Burma. No. 2684 B.M. Type.

ALYCÆUS OMISSUS, n. sp. (Plate CLV. fig. 13.)

*Locality*. Siam and Shan boundary. 2 specimens, 1228 G.-A. Coll., B.M. (*Colonel R. Woodthorpe, R.E.*).

Shell umbilicated, depressedly conoid, strong; sculpture rather distant costulation up to the end of the sutural tube, which becomes closer towards the apex and less pronounced, next the tube it is very close and regular; colour bleached; spire depressed, apex small; suture impressed, the sutural tube moderately long; whorls 4, the last is smooth in front of the sutural tube, the interval to the aperture has a slight rise in the middle; aperture circular; peristome thick, double, the outer lip well reflected—within in the lower outer margin there are a few close-set teeth-like crenulations, recalling what is to be seen in *A. sculptilis* on a far larger scale.

Size: maj. diam. 2·8; alt. axis 1·1 mm.

These specimens were received many years ago, at the time Colonel Woodthorpe was making the first survey of the country so far east as Kengtung and the Mekong River; he brought back many interesting new shells, most of which have, I am sorry to say, been undetermined by me. Evidently very much more collecting remains to be done in that part of our eastern possessions.

ALYCÆUS RUBINUS, G.-A.

Moll. Ind. vol. ii. 1897, p. 3, pl. lxiii. figs. 2, 2 *a*.

*Locality*. Ruby Mines District, Upper Burmah. No. 2685 B.M. Type.

ALYCÆUS SCULPTILIS, Bs. (Plate CXXXIX. figs. 7, 7 *a*; Plate CLV. fig. 8, aperture.)

Benson, A. M. N. H. ser. 3, xvii. (1856) p. 226; W. Blf. A. M. N. H., June 1864, p. 458, type of sec. v.; Theobald, Cat. Supp. 1876, p. 40; Hanley & Theob. Conch. Ind. 1870, p. 39, pl. xcvii. figs. 5, 6, fig. 7 as *margarita*, Th. is the same; G. Nevill, Hand-l. i. 1878, pp. 292–293, Thyetmyo, 36 specimens; Pfeiffer, Man. Pneum. ii. p. 35; Reeve, Conch. Icon. 1877, *A. microstoma*.
Specimen figured No. 2648 G.-A. Coll., B.M.

Original description:—"*Testa late umbilicata, turbinata, subtrochiformi, acute costulata; spira conica, sutura profunda, apice attenuato, acutiusculo; anfractibus* 5 *convexis, ultimo ad latus inflato eo costulis confertissimis munito, tum constricto, antice læviori, tumido, tubulo suturali mediocri, ab apertura remoto, incumbente, circa umbilicum obtuse angulato, intus concaviusculo; apertura obliqua, circulari; peristomate duplici, interiori subporrecto, incrassato, margine superne profunde inciso, interiore dextrali interne crenulato vel denticulato, externo incrassato, expanso reflexiusculo, superne incrassato prominente, ab anfractu penultimo sinu profundo separato. Operculo* —— ?
"Diam. $3\frac{1}{2}$, axis $2\frac{1}{4}$ mill.
"*Hab.* raro ad Thyet-Mio prope fluvium Irawadi, non procul a finibus provinciæ Burmanicæ Britannicæ.
"The specimen is much weathered, and has lost all its colour, so that I am unable to describe that part of its characters. It presents a new form in the genus, and exhibits a peculiar character in the slit inside the aperture at its upper part, and in the crenulation or denticulation along the callous interior of the right lip. The teeth are twelve in number and are disposed in pairs. The incision resembles that observable in some of the species of *Pterocyclos*, and there is a slight disposition towards the formation of a wing."
The aperture of this species is unlike that of any other I am acquainted with; it is not well seen in the specimen shown on Plate CXXXIX—there is only just an indication of the small crenulation on the outer and lower margin. I give an enlarged sketch of the aperture of another specimen from Thayetmyo (No. 70.06.4.4) in Dr. Blanford's collection, in which the almost denticulate border is well developed, with a tendency to arrangement in pairs.

Alycæus umbonalis, Bs.

Moll. Ind. vol. i. (1886) p. 194, pl. xliv. figs. 2–2 *c*.

Akouk-Toung, Pegu.

No. 65.06.4.4 Blf. Coll. B.M. Specimen figured taken off glass slip. No. 179.06.4.4 Blf. Coll. is a specimen from Thyetmyo, Pegu.

Alycæus vulcani, W. Blanford. (Plate CLI. figs. 5, 5 *a*.)

W. T. Blanford, J. A. S. B. 1863, xxxii. p. 323; Pfeiffer, Mon. Pneum. iii. p. 47; Theobald, Cat. Supp. 1876, p. 40; Nevill, Hand-list, i. 1878, p. 294.

Specimen figured No. 49 Blf. Coll., B.M.

*Original description* :—"Shell moderately umbilicated, depressly turbinate, thin, translucent, varying in colour from amber to nearly white, rather closely costulated throughout, more strongly on the inflated portion of the last whorl, and very closely ribbed within the umbilicus. Spire conoid, apex blunt, deep rufous; suture impressed. Whorls 4, rounded, the last moderately swollen at the side, then constricted and swelling again slightly towards the mouth. Constriction smooth; sutural tube of moderate length, about 2 mm. Aperture oblique, circular; peristome crenulately waved on the outer edge, the lowest crenulation forming a rudimentary channel at the base; peristome double, the inner alone continuous, both lips somewhat expanded; operculum thin, horny, distantly multispiral, very concave externally, internally convex and with a prominent central nucleus.

"Major diam. 4½, minor 3½, alt. 3, diam. ap. 1½ mm.

"*Habitat*. This species abounds on the upper portions of the isolated peak of Puppa, an extinct volcano lying about 40 miles E.S.E. of the town of Pagán, in the territories of the King of Ava. It is a more globose form than either *A. succineus*, mihi, or *A. polygonoma*, mihi, to which it is allied. The crenulation of the mouth is perhaps more marked than in any other Burmese species."

I have figured one of Blanford's shells, the costulation at the base of the sutural tube is particularly strong and at first distant, and I would call attention to the well-marked distant fine costulation on the smooth part of the whorl anterior to this, the four costæ behind the peristome are very noticeable. The same species has been collected near Ava; in all the examples I have looked at, the peristome is less crenulated and in two or three is hardly noticeable. The ribbing behind the peristome is quite as strongly developed.

Two single specimens (No. 50 and 180.06.4.4 Blf. Coll. B.M.), which I have compared with the type-shells, are in the Blanford Collection. No. 50 is the one referred to by him in the J. A. S. Bengal, 1862, p. 136, under *A. humilis*; Blanford had not then discovered *A. vulcani* and, the shell being imperfect, bleached, and a single specimen, he did not describe it. It is now of much

interest, as it extends the range of this species for 270 miles north up the valley of the Irrawaddy.

Alycæus woodthorpi, n. sp. (Plate CLV. fig. 14.)

*Locality.* Fort Stedman, Burma. No. 3064 G.-A. Coll., B.M. (*Colonel R. Woodthorpe, R.E.*).

Shell openly umbilicated, globosely conoid ; sculpture : oblique, sinuate costulation on upper whorls rather strong and distant as it approaches the end of the sutural tube, it then becomes very fine and very close up to the constriction ; colour pale sienna-brown ; spire moderately high, apex small ; suture well impressed ; whorls 4, the constriction near the base of the sutural tube, thus enlarging into a narrow costulated ridge which is close behind the peristome ; aperture oval, obtusely angulate above ; peristome simple, double, thick, columellar margin curving vertically.

Size : maj. diam. 4·3 ; alt. axis 2·0 mm.

The most distinguishing character of this shell is the extremely fine close regular costulation next the sutural tube, which, in most species of the genus, is strong and well defined : this character is met with again in species of the Abor Hills, such as *A. aborensis*, &c. This in conjunction with the fact that so large a proportion of species in other genera inhabiting the Abor country are not found in Western Assam, is an indication of topographical connection between the Shan area and the Tsanspu drainage-system far back in geological time, closer, more direct, and unrestricted than now exists. There are grounds for thinking that the high snowy range at the head of the Irravady, together with the well defined orographical feature the Assam Range to the west, may be a comparatively recent elevation compared to the main mass of the Eastern Himalaya.

Alycæus (Dioryx) urnula, Bs., var.

Godwin-Austen, P. Z. S. 1888, p. 245, in paper " On Some Land-Mollusks from Burma."

*Locality.* Pingoung, Shan Hills (2500 ft.).

" The only difference between this and the Assamese forms is the greater length of the sutural tube in the Burmese shell."

Mr. John Ponsonby, in whose collection it is, has most kindly let me have it to figure. I describe it below.

A single, not very well-preserved, *Dioryx* from Munipur (Pl. CLIII. fig. 10) is somewhat similar, but is more globose and not so high in the spire.

Alycæus (Dioryx) pingoungensis, n. sp. (Plate CLIII. figs. 13, 13 *a*.)

*Locality.* Pingoung, Shan Hills (*Captain Spratt, ex coll. J. Ponsonby*).

Shell solid, imperforate ; sculpture very smooth, surface with indistinct transverse striation, next the sutural tube there is fine

close costulation; colour dull white; spire high conic, apex rounded; suture well impressed, the sutural tube very long; whorls with sides very rounded; aperture circular, vertical; peristome strong and thickened, double.

Size: maj. diam. 3·10; alt. axis 2·70 mm.

This species, although very similar in all main characters to the Indian forms, as I said in 1888, is certainly quite worthy of separation. Compared with typical *urnula*, Bs., from Darjiling, it is more solid and smoother, costulate sculpture on last whorl somewhat stronger, the umbilical margin more circumscribed, peristome solid, and particularly in the distance from base of the sutural tube to the peristome being very short, forming the constricted part of the whorl, when it is compared with typical *D. urnula* from Darjiling and the variety from the Naga Hills, &c.; it thus approaches the constriction of *D. amphora*.

ALYCÆUS (DIORYX) FEDDENIANUS, Theobald. (Plate CLIII. fig. 12.)

Theobald, J. A. S. B. xxxix. pt. 2, 1870, p. 397, pl. xviii. fig. 4; Hanley & Theob. Conch. Ind. 1870, p. 38, pl. xci. figs. 1, 4; Theobald, Cat. Supp. p. 39, Upper Salwin Valley; G. Nevill, Hand-list, p. 294, 4 near Moulmein, *Dr. Hungerford*, 2 Shan States, *R. B. Fedden*, typical.

Specimen figured No. 2694 B.M. Coll.

Original description:—"*Testa globoso subturbinata, profunde umbilicata, glabra, in ultimo anfractu ad suturam peculiariter deplanata, deinde subangulata et infra angulum levissime convexiuscula seu planata et angustata, solida, brunnea; anfractibus* $3\frac{1}{2}$, *rapide crescentibus, superioribus convexiusculis, ultimo supra et prope umbilicum angulato; tubulo suturali tenui, prope aperturam oriente et fere dimidium ultimi anfractus in longitudine æquante; strictura brevissime, vix conspicua; apertura circulari, carneola, supra angustissime adnata; perist. duplici, interno integro, tenuissimo, externo breviter expansiusculo et reflexo.*

"Diam. maj. 20, d. min. 16, alt. 16 unc.

"*Habitat.* Shan States.

"This shell is an interesting addition to the *Dioryx* group, the only other Pegu form being *A.* (*Dioryx*) *amphora*, B., first procured by myself at Moulmein. The latter is a very variable shell in size, unless two forms have been confounded under it, and Mr. Fedden's collection contained two examples of it from the Upper Salwin, but I have not the means of re-examining these just now.

"Out of four species of *Alycæus* collected by Mr. Fedden three are new; so that when greater facilities exist for examining this region, we may look for large additions to this very interesting genus of operculated land-shells."

ALYCÆUS (CYCLORYX) DIFFICILIS, n. sp. (Plate CLV. figs. 2, 2 *a*.)

*Locality.* Shan Hills, 2 specimens. No. 22.06.5.5 Blf. Coll. B.M. (*Fedden*).

Shell ovately globose, *perforation hidden* ; sculpture: distant well-marked costulation on the upper whorls, much *finer next the sutural tube* and a little closer, no costulation in front of it ; colour white, neither specimen very fresh ; spire moderately high ; suture impressed, the tube very short and small ; whorls 4, well rounded, the last slightly swollen in front of the sutural tube ; aperture circular ; peristome double, inner circular, continuous, *the outer with a strong flange-like expansion on columellar margin*, expanded and reflected on outer and upper margin.

Size : maj. diam. 3·2 ; alt. axis 2·4 mm.

There is considerable similarity in this species with that of *A. thompsoni*, of Munipur, particularly in shape, but the Shan Hills form is more compactly globose, and the costulation twice as strong, the reflection of the outer lip on the columellar side is not quite similar, and the costulation next sutural tube is altogether different.

Alycæus graphicus, W. Blf., var., Theobald.

Theobald, J. A. S. B. xxxix. pt. 2, 1870, p. 398, pl. xviii. fig. 3 ; id. xxxi. pt. 2, 1862, p. 137.

*Original description* :—" Beside the typical form described by Mr. Blanford from Arrakan and Pegu, an interesting variety also occurs in the Shan States, for the identification of which I am indebted to Mr. Blanford. It differs from the type in having a shorter, more subtile, and globose shape, and by the ribs on the whorls being slightly more distant from each other and very sharp. There are also some of the stronger ribs traceable on the constriction near the aperture. The shell is pure white with the apex and the adjoining whorl beautifully pale yellow. I have given an illustration of this variety in order to facilitate comparison."

This description defines the species well, which is so decidedly distinct from *A. graphicus* ; it is worthy of specific distinction and I name it :—

Alycæus (Cycloryx) graphiarius, n. sp. (No. 21.06.4.4 Blf. Coll. B.M.) (Plate CXLVI. figs. 7, 7 *a*.)

There are four specimens in the Blanford collection, and I have come across two others in a pill-box. The distant strong costulation is very striking, with 4 very distinct ribs behind the aperture as shown in fig. 7 *a*.

Alycæus (Cycloryx) margarita, Theob. MS.

Hanley & Theobald, Conch. Ind. (1870) pl. xcvii. fig. 7, is *A. sculptilis*, Bs. ; id. pl. xcv. fig. 10 is evidently a species of *Cycloryx*—Hanley writes, p. 39 ; " Although very near *graphicus*, differs in form, sculpture, and colouring " ; Theobald, Cat. Supp. 1876, p. 40.

*Locality*. Shan States.

ALYCÆUS (CYCLORYX) SPRATTI, G.-A. (Plate CLI. figs. 10, 10 *a.*)

Godwin-Austen, P. Z. S. pt. 1, April 17th, 1888.

*Locality.* Pingoung, Shan States, 2500 ft. (*Capt. Spratt, R.A.*). Type specimen figured is in the B.M. Coll.

*Original description*:—"Shell pyramidal, closely umbilicated; sculpture very fine close costulation, more distant between the sutural tube and the peristome; colour white with pale lemon tinge or horny; spire high, rapidly decreasing to apex, which is rather pointed; suture well impressed; whorls $5\frac{1}{2}$, convex, the last swollen, slightly constricted at the sutural tube which is very short and very thick, less than one millim. in length (fig. 10 *a*); the whorl swells again to the aperture, this is circular, oblique; peristome double, slightly reflected; operculum not seen.

"This species is quite new; it might at first be taken for a small variety of *A. pyramidalis*, Bs., from the Tenasserim Valley, but the sutural tube is in that species very thread-like and nearly 3 millim. in length; the aperture is also very different in form and not so simple and circular."

With the very different pyramidal form of shell as compared with *A. constrictus*, &c., the presence of the short club-like sutural tube puts this species in the section *Cycloryx*. On the other hand, in the shell-character combined with type of sculpture, it is like species in the neighbouring country to the east and south, *A. pyramidalis* and *A. gibbus*. This points to an early development of the Section in this southern area, for *Alycæus* apparently spread northward and westward, the conchological change of form coming in on that side, first in Arakan and thence to the Himalaya. It would be most interesting to get other species presenting similar characters to *C. spratti*.

The Shan country is not a quarter worked, and they may therefore be expected to occur.

ALYCÆUS (CYCLORYX) TENELLUS, n. sp. (Plate CLV. figs. 3, 4, 4 *a.*)

*Locality.* Shan States, only one specimen. No. 87.06.5.5 Blf. Coll. B.M. (*Fedden*).

Shell scarcely perforate, elongately conoid; sculpture, none visible on upper whorls, very fine and indistinct near the very short sutural tube; colour bleached; spire high, apex small; suture impressed; whorls $4\frac{1}{2}$, sides rounded, nearly flat on side, constriction slight close up to the sutural tube, thence short and flat to the aperture; aperture circular, vertical; peristome double, the inner well reflected below, slightly flattened on the upper outer margin.

Size: maj. diam. 2·9; alt. axis 2·4 mm.

8. *Arakan* (*East of Bay of Bengal*).

| | |
|---|---|
| *Alycæus blanfordi*, n. sp. | Pl. CXLVIII. fig. 3. |
| *glaber*, W. Blf. | Pl. CLI. fig. 1. |
| (*Cycloryx*) *graphicus*, W. Blf. Type. See No. 5. | Pl. CXLVI. figs. 1, 1 *a*, 1 *b*. |
| *ingrami*, W. Blf. | Pl. XLIV. figs. 1–1 *c*. |
| *nitidus*, W. Blf. | Pl. CLI. figs. 4, 4 *a*. |
| *politus*, W. Blf. | Pl. CXXXIX. figs. 5, 5 *a*. |
| *polygonoma*, W. Blf. | Pl. CXLI. fig. 5. |
| *sandowayensis*, n. sp. | Pl. CXXXIX. figs. 4, 4 *a*. |
| *succineus*, W. Blf. | Pl. CLI. fig. 2. |
| *umbonalis*, Bs. See No. 7. | |
| *vestitus*, W. Blf. | Pl. CXXXIX. figs. 2, 2 *a*. |
| *vestitus*, W. Blf., var. *akyabensis*. | Pl. CLV. fig. 7. |

On the north of No. 8 the hills near Chittagong, the country of the Looshais, and Hill Tippera await the collector.

Alycæus blanfordi, n. sp. (Plate CXLVIII. fig. 3.)
Blf. Coll. No. 177.06.4.4 B.M.

*Locality*. Chwegali, Arakan Hills. A single specimen in the Blanford Collection.

Shell very globosely conoid, openly umbilicated; sculpture: fine, distant, raised costulation on the upper whorls, becoming close, and strong contiguous to the sutural tube; colour ruddy ochraceous; spire conoid; suture impressed, the tube long and thin; whorls 4, well rounded, constriction short, well marked in front of the tube, then expanding between that and the aperture; aperture oval, subangulate at upper inner margin; an elongate tooth on the upper margin of the peristome, which is slightly reflected, with an indication of crenation on the lower; the peristome double and much thickened; operculum black.

Size: maj. diam. 3·2; alt. axis 1·25 mm.

Although represented by a single specimen, this shell has very distinctive characters and is worthy of being named.

Alycæus glaber, W. Blanford. (Plate CLI. fig. 1.)

Blf. Coll. 181.06.4.4 B.M.

W. T. Blanford, J. A. S. B. 1865, xxxiv. pt. 2, p. 20.

*Original description*:—"Shell broadly umbilicated, conoidly depressed, solid, reddish white, the upper whorls darker, rather dull in lustre, smooth, except at the swollen portion of the last whorl, which is very finely and closely costulated. Spire depressly conoid; apex rather obtuse; suture impressed. Whorls 4, convex, the last obsoletely subangulate at the periphery, moderately swollen at the side, then constricted, descending a little near the mouth.

Constriction of moderate length, smooth, slightly swollen in the middle. Sutural tube of moderate length. Aperture diagonal, circular; peristome more or less distinctly duplex, thickened, moderately expanded. Operculum dark coloured, horny, externally concave, internally convex, with a prominent central nucleus.

"Major diameter $7\frac{1}{2}$, minor 6, axis $4\frac{1}{2}$ mm.

"*Habitat.* Akyab, Arakan; the hills south of the harbour.

"This species closely resembles *A. ingrami*, W. Blf., for which I for some time mistook it, but it is distinguished by the absence of any sculpture on the upper whorls and also by the more oblique mouth."

ALYCÆUS (CYCLORYX) GRAPHICUS, W. Blf. (Plate CXLVI. figs. 1, 1 *a*, 1 *b*.)

W. T. Blanford (*Alycæus graphicus*), J. A. S. B. xxxi. (1862) p. 137; Pfr. Mon. Helic. iii. p. 46; Hanley & Theobald, Conch. Ind. p. 39, pl. xcv. figs. 7, 8, 9; Theobald, Land & Freshw. Moll. B. I. (1876) p. 39; W. T. Blf. A. M. N. H. June 1864, p. 458 (Section II.).

*Alycæus graphicus*, W. Blf., var. *minor*, Godwin-Austen, J. A. S. B. xliii. 2, 1874, pl. iii. figs. 8, 8 *a*, is *khunhoensis*, G.-A., No. 3520 B.M.

*Alycæus graphicus*, W. Blf., var., Godwin-Austen, J. A. S. B. xlv. (1876) p. 178 ("Both in the Dikrang Dhún and on Toruputu Peak") is *paucicostatus*, G.-A., No. 2595; and there is yet another species, smaller and not so globose, quite distinct and not like *graphicus*.

Original description:—"*Testa perforata, ovato-globosa, tenuis, pallide fulva, costulis filaribus subremotis sinuatis ornata. Spira ovato-conoidea, lateribus convexis, apice obtusula, sutura impressa. Anfr. 4, rotundati, 2 primi lente, penultimus et ultimus celerius accrescentes, ultimus ad latus vix tumidus, pone stricturam spatio brevissimo confertius costulatus, tubulum suturale brevissimum gerens. Spatium constrictum læve, costula filiformi una medio plerumque signatum, prope aperturam tumidius. Apertura vix obliqua, majuscula, circularis; peristoma duplex; interno breviter porrecto, continuo; externo expanso, retrorelicto, ad umbilicum reflexo, perforationem partim celante.*

"Diam. maj. 3, min. $2\frac{1}{2}$, alt. 3, apert. diam. $1\frac{1}{2}$ mm.

"Habitat in montibus Arakanensibus provinciam Burmanam, Pegu ab Arakan secernentibus.

"A Burmese representative of the little group of Alycæi which comprises *A. constrictus* B., *A. bembex* B., and *A. otiphorus* B. *A. graphicus*, although much more globose than any of the others, is in some respects intermediate between *constrictus* and *otiphorus*, resembling the first in size and somewhat in form, and the latter in the reflexed left edge of the outer peristome. This character, however, is by no means so much developed in the Burmese as in the Darjiling species. The present has a more marked sculpture

than either of its three allies, and differs from them also in the very slight approximation of the costulation behind the constriction. Almost all the species of the genus *Alycæus* are more closely and strongly marked upon the tumid portion of the last whorl than on any other of the shell, the length of the closer ribbing and of the tumidity having a general relation to that of the sutural tube."

"Several dead specimens of *A. graphicus* were found at Moditoung, a halting-place about 55 miles from Prome, on the road across the uninhabited Arakan Yoma range from that place to Tongoop."

In William Blanford's Collection, left by him to the Trustees of the British Museum (Nat. Hist.), which I am at present engaged on carefully registering, there are five examples of *A. graphicus* from the above typical locality (No. 42.06.4.4). It is one of these I have figured.

I have not seen examples from the hill country on the north and east, Hill Tippera being quite unknown as regards the mollusca.

With a fine series to deal with I have been able to examine very closely the variation in species of the subgenus *Cycloryx*, particularly *C. graphicus*, collected over a very extensive area, from Arakan to the Eastern Himalaya and the Assam hill-ranges south of the Brahmaputra. The result has been interesting, it has defined the range of this and other species more accurately, and several appear worthy of specific distinction.

Variation in shell-character is limited in all genera. I have found in *Alycæus* it is always constant in every specimen of a series from the same locality. In *A.* (*Cycloryx*) *graphicus* and its allies I have found the most noticeable characters to be: (1) the costulation; (2) the number of costæ emanating or lying opposite to the sutural tube; (3) the form of the peristome, particularly on the upper inner margin close to the perforation, this being either more or less visible or completely covered with it.

Forty years ago, considerable confusion was the result of hasty determination of species of this group by those who took them up, because the type-specimens in the Benson and Blanford collections were not accessible and before them. Thus in Nevill's Hand-list (p. 292) *Alycæus graphicus* is recorded from the North Cachar and Naga Hills: 40 specimens collected by myself and A. W. Chennell, one of my Survey assistants, and 40 even from Darjiling collected by Dr. Stoliczka, H. F. Blanford, and Colonel Mainwaring. Not a single typical shell from Arakan was then in the Calcutta Museum. Of course all those from Darjiling are something else, and even those, judging from what I collected myself and have now before me, are not exactly similar to typical *graphicus*. Among those 40 specimens in the Indian Museum from the Eastern Frontier no doubt more than one species would be found.

I have gone through all the Alycæi in my own collection which had been recorded as *A. graphicus* or disposed of *pro tem.* as

*graphicus* var. It was found that the examples from Teria Ghat (2513 B.M.), at the foot of the Khasi Hills, came nearest to the type, but differences are soon discovered: in other words, they are not identically the same. When looked at side by side under the microscope, one notices that the sutural tube is shorter, more knob-like, that the costulation is very fine, hair-like and distant, averaging 5 adjacent to the sutural tube. The shell is larger, with the perforation hidden. In the typical Arakan shells this sutural costulation is more concentrated, 6, stronger, lying closer together, while the perforation is seen. I have examined 8 from Teria Ghat; 2 from Cherra Poonjee; 7 from the Garo Hills, 60 miles to the westward of Teria; 9 from the North Khasi scarp, 50 miles to the northward. They are all alike. But when we come to the Lhota Naga Hills, which are about 130 miles from Teria on the north of the range and well inside the drainage of the Assam Valley, variation shows itself, and in No. 2607 (18 examples) and Pikuni Hill, Naga, No. 2602 (7 examples), the sutural tube is short and bulbous, has eight quite strong contiguous lines of costulation, followed by the more distant on the rest of the shell. The peristome also shows a slight tendency to fimbriation, while the swollen part of the whorl behind it is crossed by two distant liræ. The Pikuni and Lhota Naga shells I distinguish as *A.* (*Cycloryx*) *variabilis* (see back, under No. 6).

Alycæus ingrami, W. Blf.

Godwin-Austen, Moll. Ind. vol. i. 1886, pl. xliv. figs. 1–1 *c*.
Typical species figured, Coll. Blf. No. 68.06.4.4 B.M.
*Locality.* Tongoup, Arakan.

Nevill, Hand-list, p. 292, No. 25.
Var. nagaensis, Godwin-Austen.

2 Shengorh, Dafla Hills, G.-A.=*macgregori*, G.-A.
20 Burrail, &c., Naga Hills, G.-A.=*distinctus*, G.-A.
These have been returned to the Calcutta Museum.

Alycæus nitidus, W. Blanford. (Plate CLI. figs. 4, 4 *a*.)

Specimen figured, Coll. Blf. No. 54.06.4.4 B.M.
W. T. Blanford, J. A. S. B. xxxi. 1862, p. 141.

Original description :—"*Testa anguste umbilicata, depressa turbinata, solidula, fulvo-cornea, nitida, translucens. Spira conoidea, lateribus convexis, apice obtusa, sutura impressa. Anfr.* 4, *convexi, ultimus ad peripheriam subangulato compressus, subtus planulato-convexus, ad latus breviter tumidus, ibidem confertissime costulatus. Spatium constrictum longum, nitidum, lira retro-recumbente, parum elevata, prope regionem inflatum munitum. Tubulum suturate breve. Apertura diagonalis, undata, circularis. Peristoma ad basin antice, superne prope anfractum penultimum retro sinuatum, duplex; interno continuo, breviter porrecto, basi canaliculato;*

*interno expanso, retrorelicto, in processum auriformem subtus producto. Operc. tenue corneum multispirum.*

"Diam. major $3\frac{1}{2}$, minor 3, alt. $2\frac{1}{3}$, ap. diam. 1 mm.

"*Hab.* prope Tongoop in Arakan.

"This very pretty and distinct little species occurred rarely at the roots of trees near Thaloo and Bandiyo, on the Prome and Tongoop road, not far from the last-named place. It combines the canaliculate inner peristome of *A. succineus*, with an ear-shaped process like that at the base of *A. polygonoma*; while the ridge on the peristome is curved backwards in a similar manner to that in *A. hebes*, Bens., *A. gemmula*, Bens., and *A. footei*, Blanf., although much less elevated than in either of those species, to which the shell now described has otherwise but little resemblance. The somewhat flattened base is peculiar.

"The preceding species show how numerous must be the forms belonging to this peculiar and well-marked little genus. Ten species, including *umbonalis*, *armillatus*, and *sculptilis* of Mr. Benson, have now been described from the partially explored provinces of Pegu and Arakan." In footnote:—"Since the above was written I have obtained two more species from Upper Burma."

The specimen I have figured is one of three in the Blanford Collection from Manya Khyoung, Arakan.

ALYCÆUS POLITUS, W. Blanford. (Plate CXXXIX. figs. 5, 5 *a*.)

Typical specimen figured, Blf. Coll. 178.06.4.4 B.M.

W. T. Blanford, J. A. S. B. 1865, xxxiv. pt. 2, p. 83; Hanley & Theobald, Conch. Ind. 1870, p. 39, pl. xciv. figs. 1, 2, 3; Theobald, Cat. Supp. 1876, p. 40.

*Original description*:—"Shell moderately umbilicated, turbinately depressed, smooth, polished, shining, amber-coloured. Spire depressly conoidal, suture deep; apex obtuse, rather redder than the remainder of the shell. Whorls $3\frac{1}{2}$, convex, the last round, scarcely descending towards the mouth, very little swollen at the side, and ornamented on the inflated portion for a short distance with close fine costulation, which extends beneath to the umbilicus and renders the shell opaque in that spot. Constriction long, smooth, swelling considerably in front towards the mouth. Sutural tube short, about $\frac{1}{5}$ to $\frac{1}{6}$ of the periphery of the penultimate whorl. Aperture oblique, circular, deeply sinuate at the junction with the penultimate whorl and at the lower right margin; peristome double, the inner lip projecting and continuous, outer lip retrorelict. Operculum horny, multispiral, externally concave.

"Major diameter 3, minor do. $2\frac{1}{4}$, axis $1\frac{1}{4}$ mm.

"*Habitat.* Phoungdo, near Cape Negrais, Arakan.

"Very near *A. humilis*, W. Blf., from Pegu, but distinguished by its lower spire, wider umbilicus, more sinuous mouth, and especially by its high polish, in which it is only equalled by *A. nitidus*, W. Blf."

ALYCÆUS POLYGONOMA, W. Blanford. (Plate CXLI. fig. 5.)

Specimen figured, Coll. G.-A. No. 2701 B.M., received from F. Stoliczka. Type Blf. Coll. 51.06.4.4 B.M.

Blanford, J. A. S. B. xxxi. 1862, p. 140 (not figured); Hanley & Theobald, Conch. Ind. 1870, pl. xcvi. figs. 2, 3; Theobald, Cat. Supp. 1876, p. 40; Nevill, Hand-l. i. 1878, p. 293: from Mai-i, Sandoway Dist. (*Theobald*) and Bassein (*W. T. Blanford*).

Original description:—" *Testa aperte et perspective umbilicata, turbinata, radio-striata, rubello-succinea. Spira conica, apice obtusula, sutura profunda. Anfr.* 4, *rotundati, ultimus ad latus valde inflatus, ibidem confertissime et acute costulatus; spatium constrictum longitudinis mediocris, costulato-striatum, medio in costam prominentum, intus cavo-sulcatum,* 2 *vel* 3 *costulis signatum, tumescens. Tubulum suturale mediocre,* $\frac{1}{4}$ *peripheriæ subæquans. Apertura obliqua, polygonali-circularis, basi valde antice sinuata; peristoma duplex; interno vix porrecto, margine dextro ter subangulato, basi subcanaliculato; externo incrassato-expansulo, processu brevi, acuto, basali munito.*"

" Diam. major 5, minor $4\frac{1}{4}$, alt. $3\frac{1}{2}$, ap. diam. $1\frac{3}{4}$ mm.

" *Hab.* in montibus Arakanensibus.

" This species is allied to the last described (*A. succineus*), but is distinguished by its higher spire, less marked sculpture, by the strong ridge on the constriction, and by the more polygonal aperture. The incision of the base, however, is slighter, and in this species accompanied by a slight corresponding projection beneath, which represents, on a small scale, the large ear-like basal process in *A. prosectus*, Bens., from the Khasi Hills. The inner peristome of that species also has a slight basal indentation within the aperture."

" I am indebted for a few perfect specimens of this species to Captain Ingram, who found them upon the western side of the Arakan range. I obtained one imperfect specimen at Shoukbeng on the Prome and Tongoop road, close to the summit of the hills."

ALYCÆUS SANDOWAYENSIS, n. sp. (Plate CXXXIX. figs. 4, 4*a*.)

*Locality.* Mai-i, Sandoway District, Arakan. No. 2558 B.M. *Stoliczka*).

Shell flatly conoid, openly perspectively umbilicated, flat on base; sculpture: finely costulated throughout and closely set, the coarsest is near the constriction anterior to the sutural tube; colour dark umber-brown; spire depressed, apex small; suture impressed, the sutural tube is short, stout, and slightly bent over; whorls 4, evenly increasing, the last slightly swollen near the sutural tube, then slightly constricted, and again expanding slightly towards the aperture; aperture ovate horizontally; peristome double, reflected, not solid. Columellar margin rounded.

Size: maj. diam. 9·0; alt. axis 3 mm.

This shell came into my possession through Ferd. Stoliczka, a single specimen. Since describing it I have found two examples

in the Natural History Museum from Theobald, also from Mai-i. One measures 9·25 mm. in major diameter.

Alycæus succineus, W. Blanford. (Plate CLI. fig. 2.)

Type Blf. Coll. No. 52.06.4.4 B.M.

Blanford, J. A. S. B. xxxi. 1862, p. 139; Hanley & Theobald, Conch. Ind. 1870, p. 39, pl. xcvi. figs. 7, 10; Theobald, Cat. Suppl. 1876, p. 40; Pfr. Mon. Pneum. iii. p. 50.

Original description:—"*Testa aperte umbilicata, depresso-turbinata, acute sinuato-costulata, succinea, translucens. Spira conoidea, apice obtusula, sutura impressa. Anfr. 4, ultimus ad latus inflatus, ibidem confertissime costulatus. Strictura longa, medio tumida, et duobus vel tribus costulis obliquis, sulculis internis, correspondentibus, signata. Tubulum suturale mediocre, $\frac{1}{4}$ peripheriæ subæquans. Apertura obliqua, irregulariter circularis, superne subangulata; peristoma duplex; interno continuo, incrassato, expansulo, margine dextro bis obtuse angulato, ad basin canaliculo haud intracte perforato; externo breviter expanso, retrorelicto.*

"Diam. major 5, min. 4, alt. $3\frac{1}{4}$, apert. diam. $1\frac{1}{2}$ mm.
" " 0·2, " 0·16, " 0·13, " " 0·16 inch.

"*Habitat* in montibus Arakanensibus.

"Some of the peculiarities of this species, such as the canaliculate base of the peristome and the two or three small plaits on the constriction, are repeated in that next described (*A. polygonoma*). The plaits or ridges just referred to, although they have corresponding internal hollows, are scarcely so prominent as those forming the sculpture of the upper portion of the shell. They are nearer to the mouth than to the rise of the sutural tube, and rest upon a tumidity which is scarcely sufficiently pronounced to enable the species to be assigned to the section *Charax* of Benson, although it exactly represents the well-marked ridge in the undermentioned species *A. polygonoma*. The sutural tube is, in one specimen, somewhat short of the typical length."

"Of *A. succineus* I only obtained four specimens. They occurred at Moditaung together with *A. graphicus*, &c. All were dead but in fresh condition."

Two of these I found among Blanford's shells.

Alycæus umbonalis, Bs.

Godwin-Austen, Moll. Ind. vol. i. 1886, p. 194, pl. xliv. figs. 2, 2 *a*, 2 *b*.

Blf. Coll. No. 2.06.5.5 B.M. These are the specimens from the Arakan Hills, east side on the Tongoop Road, referred to. One, varying somewhat, came from Mai-i, Arakan (ex *coll. Stoliczka*).

Alycæus vestitus, W. Blanford. (Plate CXXXIX. figs. 2, 2 *a*.)

Type Blf. Coll. No. 53[2].06.4.4 B.M.

W. Blanford, J. A. S. B. xxxi. 1862, p. 138; Hanley & Theobald,

Conch. Ind. 1870, p. 42, pl. ciii. fig. 4 (a very bad figure); Theobald, Cat. Supp. 1876, p. 40; Von Möllendorff, in Section *Orthalycæus*, Nachrbl. Deutsch. Malak. 1897, p. 148.

Original description:—"*Testa subanguste umbilicata, turbinata, solida, epidermide decidua, crassa, subtestacea, sordide albida, conferte, ad spatium inflatum confertissime costulata, induta, subepidermide rubella, lævis, spatio inflato costulato-striato. Spira conoidea, apice obtusa, sutura impressa. Anfr.* $4\frac{1}{2}$, *rotundati, ultimus teres, ad latus parum inflatus. Strictura brevis, versus aperturam vix tumidior. Tubulum suturale mediocre. Apertura fere verticalis, circularis, majuscula; peristoma duplex, interno continuo, externo expansulo, ab interno sulco separato, ad anfr. penultimum breviter interrupto.*

"Diam. major 5, min. $3\frac{1}{2}$, alt. vix 3 mm.

"*Habitat* in montibus Arakanensibus.

"Var. minor. Diam. maj. 4, min. 3, alt. $2\frac{1}{4}$ mm.

"*Habitat* cum *A. graphicus* ad Moditaung.

"But a single specimen of each variety was found. The first was obtained on the banks of the Pado Khyoung, a stream running from the Arakan range on the Pegu side in the district of Henzadat. A single specimen either of another variety or of a distinct but closely-allied species occurred to me on the banks of another stream, the Alou Khyoung, lying between the two previously mentioned localities. This form differs in having a simple lip and apparently a longer sutural tube. None of the specimens are quite fresh, although all are in fair condition and unbleached. Of the epidermis only traces remain on both shells.

"This species is not affined to any known form. It is perhaps nearer to the little group to which *A. graphicus* belongs than to any other, but it has not the short sutural tube nor the ovately conoid form which characterizes that section of the genus. The shortness of the constriction and the very slight degree in which it expands towards the aperture, connect this form somewhat with the Section *Dioryx* of Mr. Benson."

The type from Moditaung is in the Blanford Collection (No. $53^2$). This I have figured. With it, gummed on the same glass slip, was the shell mentioned above from the Alou Khyoung Stream (No. $53^1$). They are exactly the same, only in this specimen the peristome is not so fully grown. With these two there was another specimen marked "Mamya Khyoung" (No. $53^3$), which, although very much larger, presented no other difference whatever.

| | | | | |
|---|---|---|---|---|
| Size of type: | maj. diam. | 3·75; | alt. axis | 2·25 mm. |
| ,, the large var.: | ,, | 5·0; | ,, | 3·0 ,, |

Alycæus vestitus, W. Blf., var. akyabensis. 251–2 B.M. Coll. (Plate CLV. fig. 7.)

*Locality.* Baumi, Akyab. In B.M. Coll. from Theobald.

Shell moderately umbilicated, globosely conical, solid; sculpture: apical whorls smooth, then succeeds fine close costulation, stronger

next suture, adjacent to the long and fully-developed sutural tube the costulation is fine and very close together; colour pale ochraceous; spire moderately high, apex rather blunt; suture impressed; whorls $4\frac{1}{2}$, very rounded, the constriction moderate, the distance from tube to the aperture short and smooth; aperture circular, subangulate above, subvertical; peristome double, continuous, curved on the inner margin, the outer slightly reflected.

Size: maj. diam. 4·25; alt. axis 2·4 mm.

A much more globose shell than true *vestitus*. Side of spire slightly concave. I received a single specimen of this shell many years ago from W. Blanford (No. 2696 B.M.).

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## 9. *Tenasserim.*

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|---|---|
| (*Dioryx*) *amphora*, Bs. | Pl. CLIII. figs. 11, 11 *a*, 11 *b*. |
| *ataranensis*, n. sp. | Pl. CXLVIII. figs. 4, 4 *a*, 4 *b*. |
| (*Dioryx*) *labrirubidum*, n. sp. | Pl. CLV. figs. 1, 1 *a*. |
| *pyramidalis*, Bs. | Pl. CLVI. figs. 6, 6 *a*. |
| *richthofeni*, W. Blf. | Pl. CLI. fig. 9. |

Alycæus ataranensis, n. sp. (Plate CXLVIII. figs. 4, 4 *a*, 4 *b*.)

Nevill's Hand-list, i. 1878, p. 293.

"36. *Alycæus*, n. sp. (prox. *crispatus*)."

Theobald & Stol. J. A. S. B. 1872, p. 330. *A. crispatus* as occurring at Maianoung and near Moulmein.

*Locality*. 1 Ataran (ex *coll. Dr. F. Stoliczka*).

Shell globosely conoid, rather openly umbilicated; sculpture: rather distant costulation on the upper whorls (specimen being old they do not show well); colour bleached; spire moderately high, apex blunt; suture impressed; whorls 4, the last slightly swollen near sutural tube; constriction very short, a well-marked ridge rising between it and the aperture; aperture irregularly oval, oblique; peristome double, inner lip with four deep notches, with intermediate sharp notches, outer undulated, both much expanded and protruding forwards, detached from the last whorl, forming a deep notch on the inner upper margin; columellar margin rounded.

Size: maj. diam. 2·30; alt. 1·90 mm.

It is easily mistaken for *A. crispatus*, of the Naga Hills, but differs materially in the part between the suture and aperture. It is the *A. crispatus* mentioned by Theobald and Stoliczka in J. A. S. B. 1872, p. 330.

The type shell has gone back to the Indian Museum, Calcutta.

ALYCÆUS PYRAMIDALIS, Bs. (Plate CLVI. figs. 6, 6 *a*.)
Blf. Coll. No. 45.06.4.4 B.M.

Benson, A. M. N. H. xvii. 1856, p. 225; Hanley & Theobald, Conch. Ind. pl. xci. figs. 5, 6; Theobald, Cat. Supp. p. 40; Nevill, Hand-l. i. p. 293.

Original description :—"*Testa perforata, pyramidato-conica, læviuscula, confertim oblique arcuato-striatula, albido-carnea, apicem versus rubella; spira pyramidata, sutura valde impressa, apice obtusiusculo; anfractibus* $5\frac{1}{2}$ *valde convexis; ultimo postice inflato, tum constricto, deinde subtumido, aperturam versus latiori, tubulo calloso, elongato, retroverso, suturali, pone constrictionem oriente, munito; apertura obliqua, subcirculari; peristomate duplici, interno continuo, expansiusculo, externo expanso, reflexiusculo, anfractu penultimo brevissime angulatim adnato, superne antice sinuato, tum arcuato, ad umbilicum leviter emarginato. Operculo* —— ?

"Long. 12, axis 10, lat. 10 mill.

"Hab. raro ad collem Therabuin, vallis Tenasserim.

"Nearly related to the Cochin-Chinese *Alycæus gibbus*, Fér., but easily to be distinguished by its more pyramidal growth and by the greater length of the spire in proportion to the breadth of the last whorl, its more symmetrical proportions, sculpture, etc. The origin of the sutural tube is about 4 millimetres from the anterior margin of the aperture. This shell was met with at no other place in the district, and seemed restricted to a spot of a few acres in circumference. The hill is of limestone, steeply scarped and almost inaccessible. Three species of *Helix* occurred there which were similarly deficient elsewhere."

I figure and describe below the Cochin China *A. gibbus*, Fér., mentioned above, in order to show how it differs from *A. pyramidalis*, also because it was made by Wm. Blanford the type of his Section 1. of the genus in his excellent paper "On the Classification of the Cyclostomacea of Eastern Asia," Ann. M. N. H., June 1864, p. 441.

ALYCÆUS (ORTHALYCÆUS) GIBBUS, Fér. (Plate CLVI. figs. 5, 5 *a*.)

*Locality*. Cochin China, ex coll. Museum Cuming. Natural History Museum.

Shell globosely pyramidal, perforate, rather solid; sculpture fine, close, and regular striation throughout, becoming coarser and costulate on the part next the moderately long sutural tube; colour dull white on last whorl, ruddy brown on apex; spire high, attenuate, the apex smooth; suture fairly impressed; whorls, the last much swollen, the three apical rapidly decreasing; the constriction just in front of the base of the sutural tube, then swelling forward towards the aperture, this part very finely striate by lines of growth; aperture circular, oblique; peristome double, the inner lip thin and sharply reflected; columellar margin slightly curved and oblique downwards.

Size: major diam. 11·0; alt. axis 7 mm.

ALYCÆUS RICHTHOFENI, W. Blanford. Type Blf. Coll. No. 24.06.5.5. B.M. (Plate CLI. fig. 9.)

W. T. Blanford, J. A. S. B. 1863, pt. 2, p. 324; Hanley & Theobald, Conch. Ind. 1870, p. 39, pl. xciv. figs. 5, 6; Theobald, Cat. Supp. 1876, p. 40; G. Nevill, Hand-list, i. 1878, p. 293: two, south of Moulmein.

*Original description*:—"Shell umbilicated, turbinate, rather solid, closely flexuously costulated, more strongly on the inflated portion. Spire conical; apex rather acute; suture impressed. Whorls 5, rounded, the last moderately swollen at the side and subangulate at the periphery and more strongly so round the umbilicus, then much contracted, ascending slightly at the inflection, descending considerably behind the aperture. Constriction slightly costulated, crossed by a very prominent vertical ridge. Sutural tube of moderate length, about $2\frac{1}{2}$ mm. Aperture circular, very oblique. Peristome continuous, double; the inner lip projecting slightly, and waved 3 times on the dextral side. Outer lip broadly and flatly expanded. Operc. ?

"I am indebted to Baron F. v. Richthofen for the only specimen of this shell which has been found. It is perfect, but bleached. The species is quite distinct in type from any Indian or Burmese form with which I am acquainted; it combines a high conical spire with a strong ridge on the constriction, but it recalls somewhat the Javanese *A. jagori*, Martens. I have much pleasure in naming this interesting little form after the discoverer, to whom I was also indebted for some living specimens of *Raphaulus chrysalis*, Pfr., and other Moulmein shells."

The example I have figured is one in Blanford's collection. I have every reason to consider it the type described by him, although not marked so. The subangulation at the periphery is not very apparent; turning the shell about in different lights, it is now and then caught—it is quite apparent round the umbilicus.

ALYCÆUS (DIORYX) COCHINENSIS, n. sp. (Plate CLVI. figs. 7, 7 *a*.)

*Locality.* Cochin China, ex coll. Museum Cuming. Natural History Museum.

Shell rimate, globosely conical; sculpture so fine as to be almost smooth, next suture more defined regular liration is to be seen; colour white, specimen rather bleached; sutural tube short; spire fairly high, apex small; suture impressed; whorls 4, the last very globose as seen from the outer side; the constriction narrower than in any other species I have drawn, the sutural tube rising just behind and quite close to the peristome; aperture vertical, circular; peristome double, not much thickened.

Size: major diam. 5·5; alt. axis 4·75 mm.

This shell was stuck on the same slab with *Alycæus gibbus*, taken, I presume, as the young shell of that species, but the form of the apex and very smooth surface showed it to be something else—this Mr. R. C. Dobson had noticed in the remarks on invoice

of species: "1 juvenile or possibly different species." This shell is interesting, it extends the range of the subgenus *Dioryx* so much more to the eastward of the Irawadi Valley—and I introduce it here, although beyond the limits of British India.

ALYCÆUS (DIORYX) AMPHORA, Benson. (Plate CLIII. figs. 11, 11 *a*, 11 *b*.) Blf. Coll. No. 23.06.5.5 B.M. Type of the genus.

Benson, A. M. N. H. xvii. (1856) p. 226, ser. 3, vii. Jan. 1861; Hanley & Theobald, Conch. Ind. 1870, p. 38, pl. xci. figs. 2, 3; Theobald, Cat. Supp. 1876, p. 37 (Farm Caves, Kaugun); G. Nevill, Hand-list, i. 1878, p. 292 (Kargan, nr. Moulmein); Novit. Conch. vol. i. pl. 35. figs. 15, 16.

Original description:—"*Testa anguste umbilicata, ovato-globosa, exilissime costulato-striata, albido-carnea, versus apicem acutiusculum rubella; spira conica, sutura subprofunda; anfractibus* 4 *convexis, ultimo inflato, juxta aperturam constricto, tubulo suturali longissimo prope peristoma oriente; apertura verticali; peristomate duplici, continuo, interiori breviter porrecto, intus pallide aurantiaco, exteriori expanso, striatulo, incrassato; umbilico intus spiraliter striato, margine compressiusculo. Operculo* ——?

"Long. 5½, diam. obliq. 5 mill.

"Hab. ad Moulmein, et in valle Tenasserim raro.

"The shell occurs also of a smaller size. It approaches in form the Sikkim *A. urnula*, nobis, but has a more globose aspect. The extreme length of the sutural tube is remarkable; it extends so far round the last whorl as to be visible from the front on both sides of the shell. The aperture occupies about half the height of the specimen."

In Ann. Mag. Nat. Hist. Jan. 1861, Mr. Benson says:—"A curious variety of *Alycæus amphora* was sent to me from Moulmein by Major Sankey. Besides a strong angulation at the lower part of the last whorl, the shoulder of that whorl is also distinctly angulate, almost giving the appearance of a new species; but the other characters of the shell prove it to be merely a variety. It was found at the Farm Caves by Capt. Haughton."

The sculpture of this species is to be noted. As far back as the length of the sutural tube, which in the specimen drawn, taken from the Blanford Collection, is 4 mm. in length, very fine, close, regular costulation is met with, immediately followed by a smooth surface having very fine longitudinal liration at irregular distances The base of the last whorl is angulate around the umbilical region, the liration becoming within it quite strong and coarse. In this species the formation of the sutural tube is well shown. The tube and the fine costulation on the swollen portion of the last whorl are formed and advance together (*vide* fig. 11 *b*), and apparently as soon as the animal has reached the stage of secreting the tube, some retardation, caused perhaps by the extra building work laid upon it, produces an intermittent thickening of the shell, exhibited by successive close costæ.

In this specimen there had been some check to the development of the peristome, shown by a cicatrix (fig. x, x′), followed by a similar check to the secretion of shelly matter on the circular edge of the tube, which is contracted for a short distance and then resumes its original gauge. Within the aperture, a small hole may be seen where the fleshy tube from the branchial chamber enters the shelly external one.

ALYCÆUS (DIORYX) LABRIRUBIDUM, n. sp. (Plate CLV. figs. 1, 1 *a*.)

*Locality.* Near Moulmein (*Wm. Theobald*).

This species is in the Indian Museum, Calcutta, and is noted in Nevill's Hand-list, No. 22, p. 292, as a new species, but he did not name it. It is recorded as from Khargan, Ataran Valley, coll. W. Theobald, Esq., 4 spec., and Phaboo, coll. Dr. Hungerford, 2 specimens. It is the red-lipped species briefly alluded to by Theobald and Stoliczka in the Journ. Asiat. Soc. Bengal, 1872, p. 330. Geoffrey Nevill in his private copy of the Hand-list, notes this, and he had received the species from Theobald himself. Three specimens are included with the above, marked Salween, but the collector's name is not given nor the exact locality, they are slightly smaller than the type I have figured and described from Moulmein.

*Description*:—Shell rimate, elongately conical, solid; sculpture: extremely fine transverse striation throughout, not even coarser next the sutural tube except slightly so at its anterior end; colour pink throughout, stronger on the peristome, approaching red on the apex; spire high, sides flat, apex small; suture impressed; whorls 5, sides rounded, the last constricted close behind the aperture, distance to the sutural tube very short; aperture circular, strong; peristome solid, double, reflected.

Size: maj. diam. 6; alt. axis 5·2 mm.

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## 10. *Andaman and Nicobar Islands.*

*andamaniæ*, Bs.
*busbyi*, G.-A. Pl. LXIII. figs. 1–1 *b*.
*reinhardti*, Mörch.

ALYCÆUS ANDAMANIÆ, Benson.

Benson, A. M. N. H. ser. 3, vii., Jan. 1861, p. 28; Pfeiffer, Mon. Pneum. iii. p. 47; Hanley & Theob. Conch. Ind. 1870, p. 38, pl. xci. figs. 7, 10; Theobald, Cat. Supp. p. 39; G. Nevill, Hand-list, i. 1878, p. 295: Andamans, Nicobars (1 sp., *F. Stoliczka*).

Original description:—"A. *testa aperte umbilicata, conoideo-depressa, remote radiato-plicatula, plicis regionis inflatæ confertis,*

*superne subtusque rugis flexuosis spiralibus remotiusculis sculpta, ferrugineo-rubente, apice rubido, subtus pallidiore, pone aperturam cornea; spira primo planiuscula, apicem versus papillarem obtusum exerta, sutura profundiuscula; anfractibus 4, convexis, ultimo rotundato, antice descendente, tubulo suturali retroverso brevi; apertura majuscula circulari integra; peristomate subduplici, margine undique expansiusculo, extus fuscato. Operc.* —— ?

"Diam. major 5, minor 4; alt. 3 mill.

"Habitat ad Portum Blair, Insulæ Andamanicæ. Collegit Capt. J. C. Haughton (Capt. Haughton, 51st B. N.I.).

"I am indebted for a single specimen of this very distinct species of the typical section to the present Superintendent of the Penal Settlement. Including *Al. expatriatus*, Bl., from the Nilgherries, described in a late number of the 'Journal of the Asiatic Society of Calcutta,' and a new species, also belonging to the section *Charax*, from another hill-range in Southern India, to be described by Mr. W. T. Blanford, the number of known species of *Alycæus* now amounts to twenty-five."

ALYCÆUS BUSBYI, G.-A.

Godwin-Austen, P. Z. S. 1893, p. 595; id. Moll. Ind. vol. ii. 1897, p. 5, pl. lxiii. figs. 1, 1 *a*, 1 *b*.

ALYCÆUS REINHARDTI, Mörch.

*Alycæus* (*Charax*) *reinhardti*, Mörch, Vid. Medd. (Kjöbenhavn), 1871, p. 22.

*A. reinhardti*, Journal de Conchyliologie, October 1872, p. 13.

Nevill, Hand-list, i. 1878, p. 295: Batti Malve and Camorta, 3, N. coast Great Nicobar (*coll. Stoliczka*).

Original description:—"*T. conoideo-turbinata, anguste umbilicata, conferte costulato-striata, lineis confertis spiralibus in anfr. ultimo evanescentibus; color flavescens vel ochraceus præsertim in anfr. apicalibus; spira regulariter turbinata, apice obtusiusculo; anfr. convexi, ultimus teres, ad suturam 2 mill. pone aperturam constrictus, crista indistincta pone aperturam. Pone stricturam tabulus filiformis, in ipsa sutura repens et recurrens, longissimus* (3 *mill.*). *Apertura circularis, obliqua, superne angulata; peristoma duplex, labro externo tenui, reflexo, interno subincrassato, vix reflexo, umbilicum versus fere connato. Diam. maj.* 5 *mill.; diam. apert.* $2\frac{1}{2}$ *mill.*

"*Operculum calcarium, flavum, extus concavum, irregulare, spiraliter laminosum, striis incrementi peripheriam versus expressis, intus planum, læve mamilla centrali; peripheria marginata, acie sulco diviso. Diam.* $1\frac{4}{5}$ *mill.*

"*Hab.* Borde de la Rivière Galathea, sur la terre, sous les feuilles mortes (*Rhrdf.*); Kar Nicobar (*Kjlrp.*)."

11. *Southern India.*

*footei*, W. Blf.
*footei*, var.
*expatriatus*, W. Blf.

ALYCÆUS FOOTEI, W. Blf.

Blanford, Jour. Asiat. Soc. Bengal, 1861. p. 348, pl. i. fig. 3; Pfr. Mon. Pneum. iii. p. 53; Hanley & Theob. Conch. Ind. p. xiv, not figured; Theobald, Cat. Supp. 1876, p. 39; Nevill, Hand-list, i. 1878, p. 295: 3 Wynaad, 1 var. S. Canara (*Col. Beddome*).

Original description:—" *Testa aperte umbilicata, depressa, solida, ad anfractos internos striata, ad ultimum costulato-striata, ad spatium inflatum crebre costulata; spira vix elevata, apice obtusula; sutura parum impressa. Anfr.* 4 *convexi; ultimus ad latus mediocriter gibbosus, deinde constrictus, prope aperturam descendens; spatium constrictum longum, medio tumidum, striatum, costam validem retro recumbentem; peristomatis marginem dextrum ad basin attingentem, gerens; tubulus suturalis juxta constrictionem oriens mediocris,* $\frac{1}{5}$ *peripheriæ subæquans. Apertura perobliqua, circularis, nudata; perist. duplex; interno breviter porrecto, continuo; externo late expanso. Operc.* —— ?

" Diam. maj. 6, min. $4\frac{1}{2}$, alt. 3, ap. diam. $1\frac{3}{4}$ mm.; *vel* diam. maj. 0·24, min. 0·18, alt. 0·12, ap. diam. 0·07 unc.

" Habitat in montibus Kolamulliis dictis: teste *W. King*.

" This shell is nearly allied to *A. expatriatus*, Blanf., of the Nilgiris, but is distinguished principally by the possession of a recurved ridge upon the constriction, somewhat similar to that in *A. hebes*, Bens., and *A. geminula*, Bens. Other differences are the flatter suture and more oblique mouth, caused by the greater descent of the last whorl in *A. footei*, while the swelling at the side of the last whorl is somewhat greater, and the constriction more marked.

" From *A. hebes* and *A. geminula*, the present species is easily distinguishable by its flat spire, besides other characters of sculpture, &c. The ridge on the constriction in *A. footei* lies back on the top of the whorl, and meets the peristome at the base of the right margin; in the other two species the ridge is more at the side, and meets the peristome at the bottom.

" All the specimens are somewhat weathered.

" A variety of *A. expatriatus*, Blanf., was also obtained by Mr. King from the Shevroys, a group of hills about 40 miles N. of the Kolamullies. It differs from the Nilgiri form in size, measuring in its two diameters $5\frac{1}{2}$ and $4\frac{1}{2}$ mm., instead of $4\frac{1}{2} \times 3\frac{3}{4}$. It is curious thus to find the same species on two hill-groups separated from each other by at least 100 miles, while a distinct species occurs on a third small tableland but 30 miles from one of the others."

Typical *A. footei* from the Kolamullies is in the Blanford Collection

(No. 57.06.4.4), but only one example. It is quite of the type of *A. expatriatus*, constriction similar, but the shell is much more depressed. It varies slightly from different localities.

Among Blanford's numerous and valuable field-notes I find "*Alycæus footei* from the Wynaad only differs from the Shevroy type in the spire being a little higher and the constricted portion of last whorl between swollen part and mouth rather longer. The ridge on the constriction is reverted. Diam. $5 \times 4\frac{1}{4}$, axis 3."

Three rather large specimens (G.-A. Coll. No. 2592 B.M.) possess this character. Habitat Yercand, Shevroy Hills.

In the Blanford Collection, No. 777.06.1.1, from the Kadur District, Mysore, represents a variety of *A. footei*, having the ridges across the constriction high and narrow, not reverted.

No. 279, Beddome Collection, in 5 specimens from Tinevelly the same ridge is very low and inconspicuous. No. 280, same collection, are small shells, rather higher in the spire, recorded from South Canara.

I have not been able to find time to figure all the Andaman and South Indian *Alycæi*, but hope to do so in a Supplemental Part to Volume II.

ALYCÆUS EXPATRIATUS, W. Blf.

Blanford, Jour. Asiat. Soc. Bengal, 1860, xxix. p. 123; Pfr. Mon. Pneum. iii. p. 52; Hanley & Theob. Conch. Ind. 1870, p. 57, pl. cxlv. figs. 1, 4; Theobald, Cat. Supp. 1876, p. 39; Nevill, Hand-list, i. 1878, p. 295: 7 Shevroy and Nilgiri Hills (*coll. W. T. Blanford*).

Original description:—"*Testa mediocriter umbilicata, depressa, ad anfractos internos obsolete, ad ultimum fortius, ad spatium inflatum valde, crebre costulata, corneo-albida, apice diaphane rubella; spira vix elevata, apice obtusa; sutura impressa; anfr.* $3\frac{1}{2}$ *convexi, ultimus ad latus mediocriter inflatus, deinde constrictus; constrictione longa, medio tumida, glabra; tubulum suturale pone constrictionem oriens, mediocriter longum, plerumque* $\frac{1}{5}$ *peripheriæ subæquans, sed nonnullis exemplis brevius; apertura circularis, obliqua, juxta anfr. penultimum retro curvatum; perist. duplex; internum breviter porrectum, continuum, externum expansum, interruptum, columellari margine strictum. Operculum corneum, distincte multispirum. Anfr.* 7–8 *planulatis, externe perconcavum, nucleo centrali interno prominente papillari.*

"Diam. maj. $4\frac{1}{2}$, min. $3\frac{3}{4}$, alt. $2\frac{1}{2}$, apert. diam. $1\frac{3}{4}$ mm.

"*Hab.* Haud raro ad Neddoowuttom ghat, ad latus septentrionale montium 'Nilgiri' Indiæ australis et circa 3000–4000 ped. alt.

"This species appears to be more depressed in the spire than any other of the genus, except perhaps the Bornean *A. spiracellum*, A. Ad. & Reeve. Its nearest Indian ally is *A. strangulatus*, Hutton, and in size it is intermediate between that species and *A. stylifer*, Bens. It belongs to the section *Charax* of Benson, having a wide strangulation behind the peristome, crossed by a swollen ridge, which, however, in *A. expatriatus* never presents the

sharpness so remarkable in *A. stylifer* and *hebes*, but is rather a broad tumid space separating two narrow constrictions. The sutural tube is variable in length, sometimes being nearly as sharp as in *A. strangulatus*, in other specimens as long as in *A. stylifer*; the latter being the usual case, the former the exception, but both occur in perfectly fresh and full-grown specimens.

"From *A. strangulatus* the species is distinguished by its greater size, more depressed form, more oblique aperture, by the recurvation of the peristome at its junction with the penultimate whorl, the larger sutural tube, the greater distance of the ridge crossing the constriction from the mouth, and the closer sculpture. From *prosectus* and *stylifer* the characters of the peristome, which is simple in *stylifer* and expanded at the columellar margin in *prosectus*, besides the smaller size of *A. expatriatus*; from *hebes* and *gemmula* the slightly prominent ridge not recurved and the depressed form, afford abundant grounds for distinction. *A. spiracellum* of Borneo is probably closely allied, but we are only acquainted with that shell by its description. Judging therefrom, *A. expatriatus* should be distinguished by its smaller size, more narrow umbilicus, greater bluntness of the ridge in the constriction, and, in general, by the greater length of the sutural tube, a character which, however, is evidently, from its variability in this species, of less value than has hitherto been supposed.

"The species occurred near the base of Neddoowuttom ghat, and a little above the village of Goodaloor. The animal is small and colourless; the body very short; the sole undivided; tail short and rather pointed; tentacles short, yellowish; muzzle blunt, not elongated."

Wm. Blanford's shells from the typical locality are in the Natural History Museum and now before me (No. 58.06.4.4), six in number. Also two specimens (58 *a*) from the Shevroy Hills, both larger than the typical, the largest measuring 5·5 mm. major diameter. Both these have short sutural tubes, but the ridge crossing the constriction varies in elevation throughout. Another lot from the Shevroys is No. 25.06.5.5, two specimens, both fine large shells, ridge well developed, sutural tube short.

In the Beddome Collection (No. 277.12.iv.16) there are 16 examples from the Shevroys, the ridge well formed and mostly the same large size, 5·5 mm.

In the same collection are examples from a new locality, the Annamullies, Nos. 275 and 276, 19 and 16 respectively; the largest measures 6·0 mm. in major diameter, ridge is quite high and sutural tube short in all.

From South Canara there is a single specimen in the Blanford Collection (No. 34.06.5.5), the costulation near the sutural tube not quite so strong as in typical shells.

## Concluding Remarks.

With the completion of this part, the last of Volume II., I trust to supply early in 1915 an Index of Genera and Species. At the same time, as a supplemental part or volume, I hope to complete what I have put together concerning the geographical distribution of the genus *Alycæus* and of many other Indian genera I have treated of in the two volumes, particularly in connection with the physical features of the country past and present. Also to publish the results of work completed on the animals in the genera *Anadenus*, *Sivella*, *Planispira*, *Plectotropis*, *Ægista*, *Camæna*, *Glessula*, *Succinea*, &c., including many new species.

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## EXPLANATION OF PLATE CXXXIII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*, 1 *c*. | *Alycæus crenulatus*, Bs., × 8. | Western Bhutan. |
| 2, 2 *a*, 2 *b*, 2 *c*. | —— *stylifer*, Bs., × 8 & 4·5. | Do. |
| 3, 3 *a*, 3 *b*, 3 *c*. | —— *plectocheilus*, Bs., large var., × 8. | Do. |

## EXPLANATION OF PLATE CXXXIV.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus physis*, Bs., × 4·5. | Western Bhutan. |
| 2, 2 *a*. | —— *rechilaensis*, n. sp., × 8. | Do. |
| 3, 3 *a*, 3 *b*, 3 *c*. | —— *dalingensis*, n. sp., × 8. | Do. |
| 4, 4 *a*, 4 *b*, 4 *c*. | —— *plectocheilus*, Bs., typical sp., × 8. | Darjiling. |
| 5, 5 *a*. | —— *digitatus*, H. Blf., × 8. | Western Bhutan. |

## EXPLANATION OF PLATE CXXXV.

*Parvatella sogdiana*, von Martens. Samarkand.

Fig. 1. Animal seen from right side, × 1·5.
1 *a*. Ditto, left side, × 1·5.
1 *b*. Shell, × 1·5.
1 *c*. Part of generative organs, × 4·5.
1 *d*. Male organ, × 4·5.
1 *e*. Jaw, × 12.
1 *f*. Teeth of the radula at different parts of the row, × 368.

*Durgella naharaniensis*, G.-A. Assam.

Fig. 2. Animal, right side of, × 4·5.
2 *a*. Ditto, left side, × 4·5.
2 *b*. Shell, front view with animal in hardened state, × 4·5.
2 *c*. Some teeth of the radula, much enlarged.

## EXPLANATION OF PLATE CXXXVI.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus strangulatus*, T. Hutton, × 8. | Mussoorie. |
| 2, 2 *a*, 2 *b*. | —— *lenticulus*, G.-A. Type. × 8. | Darjiling. |
| 3, 3 *a*. | —— *montanus*, Nevill. Type. × 8. | Sikkim. |
| 4, 4 *a*, 4 *b*. | —— *lenticulus*, G.-A. × 8. | Sikkim. |
| 5, 5 *a*, 5 *b*. | —— *lectus*, G.-A. Type. × 8. | Darjiling. |

## EXPLANATION OF PLATE CXXXVII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus lohitensis*, n. sp., × 4·5. | Lohit Valley, Assam. |
| 2, 2 *a*, 2 *b*. | —— *distinctus*, G.-A., × 4·5. | Sadia. |
| 3, 3 *a*, 3 *b*. | —— *tanghali*, n. sp., × 8. | Munipur. |
| 4, 4 *a*, 4 *b*. | —— *nowgongensis*, n. sp., × 8. | Assam. |
| 5, 5 *a*. | —— *jaintiacus*, G.-A., var. *crassus*, × 8. | Nongjinghi, Jaintia Hills. |

## EXPLANATION OF PLATE CXXXVIII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus magnus*, G.-A., × 4·5. | Eastern Naga Hills. |
| 2, 2 *a*, 2 *b*. | —— *habiangensis*, n. sp., × 8. 2 *b* × 4·5. | West Khasi Hills. |
| 3, 3 *a*. | —— *levis*, n. sp., × 4·5. | Munipur. |
| 4. | —— *theobaldi*, W. Blf., var. *diyungensis*, × 4·5. | N. Cachar. |
| 5, 5 *a*. | —— *nongtungensis*, n. sp., × 8. | Jaintia Hills. |
| 6, 6 *a*, 6 *b*. | —— *conicus*, G.-A., var. *nanus*, G.-A., × 8. | N. Cachar. |
| 7. | Do. Do. Do. | Jhiri Valley, Munipur. |
| 8, 8 *a*, 8 *b*. | —— *generosus*, n. sp., × 8. | Khasi Hills. |

## EXPLANATION OF PLATE CXXXIX.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus anonymus*, G.-A., Blf. MS., × 8. | Pegu. |
| 2, 2 *a*. | —— *vestitus*, W. Blf. Type. × 8. | Arakan. |
| 3, 3 *a*. | —— *bifrons*, Theobald. × 8. | Shan Hills. |
| 4, 4 *a*. | —— *sandowayensis*, n. sp., × 4·5. | Arakan. |
| 5, 5 *a*. | —— *politus*, W. Blf., × 8. | Do. |
| 6, 6 *a*. | —— *kengtungensis*, n. sp., × 8. | Kengtung, Shan States. |
| 7, 7 *a*. | —— *sculptilis*, Bs., × 8. | Burma. |

## EXPLANATION OF PLATE CXL.

*Kasperia mayæ*, n. sp. Kashmir.

| | |
|---|---|
| Fig. 1. | Animal, viewed from the right side, × 1·5. |
| 2. | Ditto, sole of foot, anterior end, × 1·5. |
| 3. | Ditto, the respiratory aperture, × 2·5. |
| 4. | The mantle, (*s*.) position of shell, × 4·5. |
| 5. | Shell, upper surface, × 4·5. |
| 6. | Teeth of radula, central and median, × 368. |
| 6 *a*. | Ditto, marginals, × 368. |
| 7. | The heart (*h*.) and kidney (*k*.) and branchial cavity (*br.cav.*), × 4·5. |
| 8. | Genitalia, × 4·5. *ant.* anterior side; *post.* posterior side. |
| 9. | Ditto, another view, × 4·5. |
| 10. | Ditto, ditto, × 4·5. |
| 11. | Ditto, penis, longitudinal section through to show internal wall of. |
| 12. | Spermatophore, × 12. |

*hg*, hermaphrodite gland; *hd*, the duct; *alg*, albumen gland; *vd*, vas deferens; *sp*, spermatheca; *ov*, ovotestis; *pr*, prostate; *gen.ap*, generative aperture; *r.m.p*, retractor muscle of penis.

## EXPLANATION OF PLATE CXLI.

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*. | *Alycæus akhaensis*, n. sp., × 8. | Akha hills, foot of. |
| 2, 2 *a*, 2 *b*. | —— *macgregori*, n. sp., × 4·5. | Dafla Hills. |
| 3, 3 *a*. | —— *lahupaensis*, n. sp., × 8. | Munipur Hills. |
| 4. | —— *barowliensis*, n. sp., × 8. | Akha Hills. |
| 5. | —— *polygonoma*, W. Blf., × 4·5. | Arakan. |
| 6, 6 *a*. | —— *burroiensis*, n. sp., × 8. | Dafla Hills. |
| 7, 7 *a*. | —— *rugosus*, n. sp., × 8. | Do. |
| 8. | —— *kamakiaensis*, n. sp., × 4·5. | Assam Valley. |

## EXPLANATION OF PLATE CXLII.

*Parmacella kojhakensis*, G.-A. West side Kojhak Pass, Afghanistan.

Fig. 1. Animal, right side of, × 2·5.
2. Animal, anterior portion, × 2·5.
3. Ditto, posterior to end of foot, × 2·5.
4. Shell in position, seen from above, with the mantle cut open and turned back, × 4.
5. Shell, underside, × 4.
6. Generative organs, enlarged.
6 *a*. Ditto, portion of, × 4.
7. Jaw, × 12.
8. Teeth of the radula, × 368.

*hg*, hermaphrodite gland; *hd*, hermaphrodite duct; *r.m.p*, retractor muscle of penis.

*Parmacella deshayesei*, Moquin-Tandon. Oran, N. Africa.

Fig. 9. Animal from life, nat. size.
9 *a*. Ditto, part of the generative organs, × 4·5. To show the accessory organs.

$cl^1$, $cl^2$, clitoris of Simroth; *bc*, bursa copulatrix; *vd*, vas deferens; *sp*, spermatheca; *ov*, oviduct; *p*, the position of penis, removed.

## EXPLANATION OF PLATE CXLIII.

[All enlarged, varying in amount.]

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*. | *Alycæus prosectus*, Bs. | Teria Ghat, Khasi Hills. |
| 2, 2 *a*, 2 *b*. | —— *nagaensis*, G.-A. | Asalu, N. Cachar. |
| 3, 3 *a*, 3 *b*. | —— *jaintiacus*, G.-A. | Jaintia Hills. |
| 4, 4 *a*, 4 *b*. | —— *conicus*, G.-A. | East of Kopili River. |
| 5, 5 *a*, 5 *b*. | —— *diagonius*, G.-A. | Diyung Valley, nr. Asalu. |
| 6, 6 *a*, 6 *b*. | —— *pusillus*, G.-A. | Jawai, Jaintia Hills. |
| 7, 7 *a*, 7 *b*. | —— *khasiacus*, G.-A. | Lailangkote, Khasi Hills. |
| 8, 8 *a*, 8 *b*. | —— *crenatus*, G.-A. | Hengdan Pk., N. Cachar Hills. |
| 9, 9 *a*. | —— (*Dioryx*) *urnula*, Bs., var. | Marangsip Pk., Jaintia. |
| 10, 10 *a*. | —— (*Cycloryx*) *graphicus*, W. Blf., var. | N. Khasi. |
| 11, 11 *a*. | —— (——) *mangutensis*, n. sp. | Jawai, Jaintia. |

## EXPLANATION OF PLATE CXLIV.

[All enlarged, varying in amount.]

| | | |
|---|---|---|
| Fig. 1 *b*, 1 *c*, 1 *d*. | *Alycæus inflatus*. G.-A. | Naga Hills. |
| 1, 1 *a*. | —— *inflatus*, G.-A., var. Locality? | Assam. |
| 2, 2 *a*, 2 *b*. | —— *strigatus*, G.-A. | Assam. |
| 3, 3 *a*, 3 *b*, 3 *c*. | —— *stoliczkii*, G.-A. | Naga Hills. |
| 4, 4 *a*, 4 *b*. | —— *globulus*, G.-A. | Munipur, Naga Hills. |
| 5, 5 *a*, 5 *b*. | —— *bicrenatus*, G.-A. | Naga Hills. |
| 6, 6 *a*, 6 *b*. | —— *serratus*, G.-A. | Munipur. |
| 7, 7 *a*. | —— *multirugosus*, G.-A. | Munipur, Naga Hills. |
| 8, 8 *a*. | —— *burtii*, G.-A. | Akha Hills, Assam. |
| 9, 9 *a*. | —— (*Cycloryx*) *khunhoensis*, n. sp. | Naga Hills. |

## EXPLANATION OF PLATE CXLV.

[All enlarged, varying in amount.]

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*. | *Alycæus crispatus*, G.-A. | Eastern Garo Hills. |
| 2, 2 *a*, 2 *b*. | —— *asaluensis*, n. sp. | Phulong, North Cachar. |
| 3, 3 *a*, 3 *b*. | —— *distinctus*, G.-A. (*ingrami*, var.). | Asalu, Cachar. |
| 4, 4 *a*, 4 *b*. | —— *theobaldi*, W. Blf. | Khasi Hills. |
| 5, 5 *a*, 5 *b*. | —— *hebes*, Benson. | Teria Ghat, Khasi Hills. |
| 6, 6 *a*, 6 *b*, 6 *c*. | —— *sculpturus*, G.-A. Type. | N.E. Munipur. |
| 7. | —— *crispatus*, G.-A. | Eastern Garo Hills. |
| 8, 8 *a*, 8 *b*. | —— *notatus*, G.-A. | Dafla Hills. |
| 9, 9 *a*. | —— *mutatus*, G.-A. | Do. |
| 10. | —— *toruputuensis*, operculum enlarged. | Do. |
| 11, 11 *a*, 11 *b*. | —— *daflaensis*, G.-A. | Do. |

## EXPLANATION OF PLATE CXLVI.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus* (*Cycloryx*) *graphicus*, W. Blf., × 8. | Arakan. |
| 1 *b*. | Last whorl, showing constriction and sutural tube with the adjacent costulation. × 12. | |
| 2, 2 *a*, 2 *b*. | *Alycæus* (*Cycloryx*) *graphicus*, var., similar enlargement. | Teria Ghat. |
| 3, 3 *a*. | —— (——) *thompsoni*, n. sp., × 8. | Munipur. |
| 4. | —— (——) *graphicus*, var. *variabilis*, last whorl, × 12. | Lhota Naga. |
| 5, 5 *a*. | —— (——) *mangutensis*, n. sp., × 8 & 12. | Jaintia Hills. |
| 6, 6 *a*. | —— (——) *graphicus*, W. Blf., var. *dihingensis*, × 8 & 12. | Dihing Valley, E. Assam. |
| 7, 7 *a*. | —— (——) *graphiarius*, n. sp., × 8 & 12. | Shan Hills. |

## EXPLANATION OF PLATE CXLVII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus* (*Cycloryx*) *bembex*, Bs., × 8. | Darjiling. |
| 2. | —— (——) *otiphorus*, Bs., × 8. | Do. |
| 2 *a*. | —— (——) ——, × 45. | Do. |
| 2 *b*. | —— (——) ——, × 12. | |
| 3, 3 *a*. | —— (——) *summus*, n. sp., × 8. | Rechila Peak, Sikkim. |

| | | |
|---|---|---|
| Fig. 4, 4 *a*. | *Alycæus* (*Cycloryx*) *constrictus*, Bs., × 8. | Darjiling. |
| 5, 5 *a*. | —— *paucicostatus*, n. sp., × 8 & 12 respectively. | Dafla Hills. |
| 6, 6 *a*. | —— *burrailensis*, n. sp., × 8 & 12 respectively. | Naga Hills. |
| 7. | —— *multicostulatus*, n. sp., × 8. | Munipur. |
| 8. | —— *khunhoensis*, n. sp., × 8. | Naga Hills. |
| 9. | —— *elegans*, n. sp., × 8. | Shengorh Peak, Dafla Hills. |

## EXPLANATION OF PLATE CXLVIII.

| | | |
|---|---|---|
| Fig. 1. | *Alycæus muspratti*, n. sp., Beddome MS., × 8. | E. Naga. |
| 2. | —— *oglei*, n. sp., × 8. | E. Assam. |
| 3. | —— *blanfordi*, n. sp., × 8. | Arakan. |
| 4, 4 *a*, 4 *b*. | —— *ataranensis*, n. sp., × 12. | Tenasserim. |
| 5, 5 *a*. | —— *crispatus*, G.-A., var. *minimus*, × 12. | Garo Hills. |
| 6, 6 *a*. | —— *dikrangensis*, n. sp., × 4·5 & 8. | Dafla Hills. |
| 7. | —— *commutatus*, n. sp., × 12. | Probably Akha. |
| 8. | —— *bhutanensis*, n. sp., × 4·5. | Do. |
| 9, 9 *a*. | —— *davisi*, n. sp., × 4·5. | Shan Hills. |

## EXPLANATION OF PLATE CXLIX.

| | | |
|---|---|---|
| Fig. 1. | *Alycæus kezamaensis*, n. sp., × 8. | Naga Hills. |
| 2, 2 *a*. | —— *edei*, n. sp., × 8. | Cachar. |
| 3, 3 *a*, 3 *b*. | —— *toruputuensis*, G.-A., Nevill MS., × 8. | Dafla Hills. |
| 4. | —— *distinctus*, G.-A., var., × 8. | Cachar. |
| 5, 5 *a*. | —— *beddomei*, n. sp., × 8. | Naga Hills. |
| 6, 6 *a*. | —— *gemma*, n. sp., × 8. | Dafla Hills. |
| 7. | —— *yetayensis*, n. sp., × 4·5. | Do. |
| 8. | —— *mundulus*, n. sp., × 8. | Do. |
| 9. | —— *aborensis*, n. sp., × 4·5. | Abor Hills. |
| 10. | —— *vesica*, n. sp., × 4·5. | Do. |

## EXPLANATION OF PLATE CL.

*Parvatella austeniana*, Nevill. Sonamurg, Kashmir.

| | |
|---|---|
| Fig. 1. | Animal of small specimen: part of shell removed, showing right shell-lobe and dorsal lobes, &c., × 8. |
| 1 *a*. | Ditto Ditto viewed from the left side; foot with visceral sac, × 8. |
| 1 *b*. | Edge of mantle with left shell-lobe (*lsl*), × 8. |
| 1 *c*. | Penis detached, with large coiled cæcum and retractor muscle, × 8. |
| 1 *d*. | The amatorial organ or dart-sac, × 8. |
| 1 *e*. | Spermatheca, × 8. |
| 1 *f*. | The heart and kidney, × 8. |
| 1 *g*. | The spermatheca of small specimen, containing the spermatophore, × 24. |

*Macrochlamys* (*Rhadella*) *kashmirensis*, Nevill. Sonamurg, Kashmir.

| | |
|---|---|
| Fig. 2. | Part of the genitalia: penis and amatorial organ, × 24. |
| 2 *a*. | The animal: shell removed, showing end of foot, × 4·5. |
| 2 *b*. | Jaw, × 58. |

*Macrochlamys decursus*, n. sp. Munipur.

Fig. 3. The right shell-lobe, with right and left dorsal lobes next the respiratory orifices. No. 581 B.M. Coll.

*Sitala pealii*, n. sp. Cachar.

Fig. 4, 4 *a*. Teeth of the radula, × 1100.

*Vallonia humilis*, Hutton. N.W. Himalaya.

Fig. 5. Jaw, × 175.
5 *a*. Centre and admedian teeth of radula.
5 *b*. Marginal teeth, × 1100.

## EXPLANATION OF PLATE CLI.

| | | |
|---|---|---|
| Fig. 1. | *Alycæus glaber*, W. Blf., × 4·5. | Akyab. |
| 2. | —— *succineus*, W. Blf., × 12. | Arakan. |
| 3, 3 *a*. | —— *armillatus*, Bs., × 12. | Pegu. |
| 4, 4 *a*. | —— *nitidus*, W. Blf., × 8. | Arakan. |
| 5, 5 *a*. | —— *vulcani*, W. Blf., × 8. | Burma. |
| 6. | —— *avæ*, W. Blf., × 8. | Do. |
| 7, 7 *a*. | —— *kurzianus*, Theob. & Stol., × 8. | Pegu. |
| 8. | —— *humilis*, W. Blf., × 12. | Do. |
| 9. | —— *richthofeni*, W. Blf., × 12. | Moulmein. |
| 10, 10 *a*. | —— *spratti*, G.-A., × 4·5. | Burma. |

## EXPLANATION OF PLATE CLII.

*Cathaica hookeri*, n. sp. Darjiling.

Fig. 1. Shell, front view, × 1·5.
1 *a*. Ditto, from above, × 1·5.
1 *b*. Extremity of the foot, side view, × 4·5.
1 *c*. Ditto, showing the sole, × 4·5.
1 *d*. The generative organs, × 8.
1 *e*. Dart-sac, × 24.
1 *f*. Ditto, × 8.
1 *g*. Jaw, × 12·4.
1 *h*. Centre and admedian teeth of the radula. Centre, with 1, 2, and 3 and 11, 12, 13. Much enlarged.
1 *i*. Buccal mass (*b*) with retractor muscle, and part of intestine (*i*), × 4·5.

*Zonitoides notabilis*, Sykes. Ceylon.

Fig. 2. Animal, view of left side with shell, × 8.
2 *a*. Ditto, head and part of mantle, right side, × 8.
2 *b*. Ditto, visceral sac showing position of penis and dark under wall of the branchial sac, × 4·5.
2 *c*. Jaw, × 58.
2 *d*. Part of generative organs, showing penis and dart-sac, × 24.
2 *c*. Part of same detached, spermatheca, × 24.
2 *f*. Ditto, another view of penis and dart-sac, × 24.
2 *g*. Genitalia, three figures showing different views of.

*b*, buccal mass; *d*, dart-sac; *i*, intestine; *gen.ap*, generative aperture; *h*, heart; *ov*, ovotestis; *p*, penis; *r.m.p*, retractor muscle of penis; *sp*, spermatheca; *vd*, vas deferens.

## EXPLANATION OF PLATE CLIII.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus* (*Dioryx*) *urnula*, Bs., × 7. | Darjiling. |
| 2. | —— (——) ——, large variety, × 7. | W. Bhutan. |
| 3, 3 *a*. | —— (——) ——, var. *pisum*, × 7. | Jaintia Hills. |
| 4. | —— (—— ) ——, var. *daflaensis*, × 7. | Dafla Hills. |
| 5, 5 *a*. | —— (——) ——, var. *anghamiensis*, × 7. | Naga Hills. |
| 6, 6 *a*. | —— (——) ——, Do. type, × 7. | Japvo Pk., Naga Hills. |
| 7. | —— (——) ——, var. *pisum*, × 7. | West Khasi. |
| 8. | —— (——) ——, var. *globosus*, × 7. | E. Assam. |
| 9, 9 *a*. | —— (——) *urceolus*, n. sp., × 7 & 4. | Abor Hills. |
| 10. | —— (——) *urnula*, Bs., var., × 7. | Munipur. |
| 11, 11 *a*. | —— (——) *amphora*, Bs., × 7. | Moulmein. |
| 11 *b*. | —— (——) ——, sutural tube, × 10·7. | |
| 12. | —— (——) *feddenianus*, Theobald, × 7. | Upper Salwin. |
| 13, 13 *a*. | —— (——) *pingoungensis*, G.-A., × 7. | Burma. |

## EXPLANATION OF PLATE CLIV.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus* (*Cycloryx*) *constrictus*, Bs., × 8. | Darjiling. |
| 2, 2 *a*. | —— (——) *costatus*, n. sp., × 8. | Dafla Hills. |
| 3, 3 *a*. | —— *crispatus*, G.-A., var. *rywukensis*, × 8 & 12·5. | Garo Hills. |
| 3 *b*. | —— ——, × 12·5. | Do. |
| 4, 4 *a*. | —— *sylheticus*, n. sp., × 8. | South Sylhet. |
| 5. | —— *neglectus*, n. sp., × 4·5. | Dafla Hills. |
| 6. | —— *rotundatus*, n. sp., × 4·5. | Do. |
| 7, 7 *a*. | —— *birugosus*, n. sp., var., × 8. | Jaintia Hills. |
| 8, 8 *a*. | —— *subinflatus*, n. sp., × 4·5. | N.E. Munipur. |
| 9, 9 *a*. | —— *obscurus*, n. sp., × 8. | Cherra Poonjee. |
| 10, 10 *a*. | —— *teriaensis*, n. sp., × 8. | Teria Ghat. |
| 11. | —— *canaliculus*, n. sp., × 8. | Do. |

## EXPLANATION OF PLATE CLV.

| | | |
|---|---|---|
| Fig. 1, 1 *a*. | *Alycæus labrirubidum*, n. sp., × 4·5. | Moulmein. |
| 2, 2 *a*. | —— *difficilis*, n. sp., × 8. | Shan Hills. |
| 3. | —— *tenellus*, n. sp., × 8. | Do. |
| 4, 4 *a*. | —— ——, × 8. | Do. |
| 5. | —— *cucullatus*, Theobald, × 8. | Do. |
| 6. | —— *logtakensis*, n. sp., × 8. | Munipur. |
| 7. | —— *vestitus*, W. Blf., var. *akyabensis*, × 8. | Arakan. |
| 8. | —— *sculptilis*, Bs., × 12. | Burma. |
| 9, 9 *a*. | —— *birugosus*, G.-A., var. *minor*, × 12. | Garo Hills. |
| 10. | —— *theobaldi*, W. Blf., var. *solidus*, × 8. | Do. |
| 11. | —— *perplexus*, n. sp., × 8. | Khasi Hills. |
| 12. | —— *notus*, n. sp., × 8. | Shan Hills. |
| 13. | —— *omissus*, n. sp., × 8. | Eastern Shan. |
| 14. | —— *woodthorpi*, n. sp., × 8. | Shan Hills. |
| 15, 15 *a*. | —— *nattoungensis*, n. sp., × 8. | Do. |

## EXPLANATION OF PLATE CLVI.

| | | |
|---|---|---|
| Fig. 1, 1 *a*, 1 *b*. | *Alycæus magnificus*, n. sp., × 8. | Abor Hills. |
| 2. | —— *yamneyensis*, n. sp., × 4·5. | Do. |
| 3, 3 *a*. | —— *panggiana*, n. sp., × 4·5. | Do. |
| 4, 4 *a*. | —— *sibbumensis*, n. sp., × 4·5. | Do. |

| | | |
|---|---|---|
| Fig. 5, 5 *a.* | *Alycæus gibbus*, Fér., × 4·5. | Cochin China. |
| 6, 6 *a.* | —— *pyramidalis*, Bs., × 4·5. | Tenasserim. |
| 7, 7 *a.* | —— (*Dioryx*) *cochinensis*, n. sp.?, × 4·5. | Cochin China. |
| 8. | —— *stylifer*, Bs., × 8; sutural tube, as seen from the inside. | Sikkim. |

## EXPLANATION OF PLATE CLVII.

| | | |
|---|---|---|
| Fig. 1, 1 *a.* | *Alycæus* (*Dioryx*) *globulosus*, n. sp., × 8. | Abor Hills. |
| 2, 2 *a.* | —— *duoculmen*, n. sp., × 8. | Do. |
| 3, 3 *a.* | —— *duorugosus*, n. sp., × 8. | Naga Hills. |
| 4, 4 *a.* | —— *oakesi*, n. sp., × 12. | Abor Hills. |
| 5, 5 *a.* | —— *chanjukensis*, n. sp., × 4·5. | Do. |
| 6, 6 *a.* | —— *luyorensis*, n. sp., × 4·5. | Do. |
| 7, 7 *a.* | —— *varius*, n. sp., × 8. | Lhota Naga. |
| 8. | —— *mutatus*, G.-A., × 8. | Dafla Hills. |

## EXPLANATION OF PLATE CLVIII.

| | | |
|---|---|---|
| Fig. 1. | *Vallonia ? humilis*, Hutton, × 12. | N.W. Himalaya. |
| 2. | *Pseudokaliella dihingensis*, n. sp., × 4·5. | Eastern Assam. |
| 3. | —— *akhaensis*, n. sp., × 4·5. | Eastern Bhutan. |
| 4. | *Sitala pealii*, n. sp., × 8. | Eastern Assam. |
| 5. | —— *subinjussa*, n. sp., × 8. | Nilgiris. |
| 6. | —— *vaga*, n. sp., × 8. | Do. |
| 7. | *Kaliella minutissima*, n. sp., × 12. | Do. |
| 8. | *Helix* (*Endodonta* ?) *rotundus*, n. sp., × 8. | Do. |
| 9. | *Macrochlamys silcuriensis*, n. sp., × 8. | Cachar. |
| 10. | *Kaliella tholus*, n. sp., × 8. | Nilgiris. |
| 11. | —— *henzadaensis*, n. sp., × 8. | Pegu. |
| 12. | —— *radicita*, n. sp., × 12. | Nilgiris. |
| 13, 13 *a.* | *Alycæus crispatus*, G.-A., var. *makarsæ*, G.-A., × 8. | N. Khasi. |

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2